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The Douglas-Fir/White Spirea Habitat Type in Central Idaho: Succession and Management

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RESEARCH SUMMARY

A succession classification system for the Douglas-fir/white spirea habitat type is presented. It is based on reconnaissance sampling of 202 stands: 55 undisturbed sites, 14 pairs of undisturbed and disturbed sites, and 119 additional disturbed sites. A total of 10 potential tree layer types, 35 shrub layer types, and 45 herb layer types are categorized by a hierarchical taxonomic classification. Diagnostic keys based on indicator species are provided for field identification of the layer types.

Implications for natural resource management are provided based on field data and observations. These implications include: potential for pocket gopher damage and success of tree plantations by site preparation treatments, initial growth rates of tree seedlings and yield capability of mature trees, microsite needs of natural tree seedlings, big-game and livestock forage preferences for specific shrub and herb layer types, and responses of major shrub and herb layer species to various disturbances. Species composition data for each of the sampled shrub and herb layer types are displayed in appendixes.

ACKNOWLEDGMENTS

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INTRODUCTION

This report is the fifth of a series dealing with succession and management of forest habitat types in central Idaho (Steele and Geier-Hayes 1987b, 1989b, 1992, 1993). It explores the responses of vegetation to specific disturbances and some resource values in one ecosystem, the *Pseudotsuga menziesii/Spiraea betulifolia* habitat type (PSME/SPBE h.t.) (Steele and others 1981). It is intended for site-specific application, providing disturbance responses for existing and potential plant species on a particular site. Because of the way these reports are developed (see Methods), the reader should focus on the relative nature of the data presented rather than the absolute values.

This report uses a classification concept (Steele 1984) that recognizes the somewhat independent successions of the tree, shrub, and herb layers in forest ecosystems (often due to layer-specific disturbances such as selective tree harvesting or grazing). It treats these three layers with separate succession classifications. It recognizes the potential diversity in early and midseral vegetation and the relative forage values for livestock and big game. Interrelationships of site treatment, planted tree survival, competing vegetation, and pocket gopher populations are also addressed. Perhaps most important, succession classifications provide a common ecological framework for communication among various disciplines.

The objectives of this report are:

1. To develop a classification of seral community types in the PSME/SPBE h.t. based on indicator species and vegetation structure.
2. To identify the successional hierarchy of community types, relating these communities to the management treatments that give rise to them.
3. To present species composition and canopy coverage information for each of the shrub and herb layers sampled, indicating the relative value of these layers as forage for big game and livestock.
4. To describe suitable conditions for natural and artificial establishment of trees and their early growth characteristics in relation to site treatment, microsite conditions, and competing vegetation.
5. To determine the number of years required for each tree species to reach breast height (4.5 feet, 1.4 meters) in the PSME/SPBE h.t. when plant competition is minimized.
6. To provide a basis for developing preliminary management implications by seral community type.

METHODS

The methods used in this study are identical to those used in the previous four studies; details are available in the earliest report (Steele and Geier-Hayes 1987b). In general, sampling methods were similar to those used in the central Idaho habitat type study (Steele and others 1981). Circular plots (375 square meters or 4,035 square feet) were subjectively located to represent the site conditions and vegetation diversity throughout the geographic range of the habitat type. Recorded observations included age of last disturbance (such as a fire or logging), plant coverage (by species), percent survival of planted tree seedlings and the age at which they reach 4.5 feet (1.4 meters), occurrence of pocket gopher mounds, snow damage to tree seedlings, methods of logging, slash disposal, site preparation, and thickness of the duff layer. Plant coverage data were used to develop a succession classification (Steele 1984); later they were assembled in synthesis tables (Mueller-Dombois and Ellenberg 1974) to verify the early seral to climax arrangement of stands as indicated by the classification.

THE PSME/SPBE HABITAT TYPE

The PSME/SPBE h.t. is distributed mainly across central Idaho. Small portions of the habitat type extend northward to the Selway-Bitterroot Wilderness (Cooper and others 1991) and into western Montana (Pfister and others 1977). It also occurs as a minor type in eastern Idaho and western Wyoming (Steele and others 1983) and extends into eastern Oregon (Johnson and Simon 1987).

Table 1—Elevational range and important tree species in phases of the PSME/SPBE h.t.

Tree species[1]	Phases and elevational range (ft) PIPO 3,300-6,600	CARU 6,000-7,900	SPBE 6,500-8,100
Abies grandis	a[2]	—	—
Abies lasiocarpa	a	—	—
Picea engelmannii	a	a	—
Pinus contorta	(s)	(S)	(s)
Pinus flexilis	—	a	a
Pinus ponderosa	S	—	—
Populus tremuloides	(S)	(S)	(s)
Pseudotsuga menziesii	C	C	C

[1]Revised from Steele and others (1981).
[2]C = major climax; S = major seral; a = accidental; s = minor seral; ( ) = occurs in part of the phase; — = absent.

In central Idaho, the PSME/SPBE h.t. appears most frequently in the Boise River drainage that dissects the southernmost lobe of the Idaho batholith. Here substrate conditions are mainly coarse-textured granitics that retain little moisture and dry rapidly following spring snowmelt. In these situations, adjacent drier sites are usually the Douglas-fir/elk sedge habitat type; adjacent moister sites, if not riparian, are mainly the Douglas-fir/ninebark or Douglas-fir/mountain maple habitat types. North of this area the PSME/SPBE h.t. becomes less frequent but is found on volcanic substrates as well as granitics.

To the northwest of the Boise River drainage, the PSME/SPBE h.t. is often replaced by the Douglas-fir/common snowberry habitat type, which has a similar appearance but is found in areas receiving slightly more moisture. The increased moisture can result from either finer textured substrates or a more favorable climate. Northward through this area the climate becomes more maritime, and the PSME/SPBE h.t. occupies increasingly severe topographic positions that reflect environmental equivalents of the extensive acreages of the PSME/SPBE h.t. in the Boise River drainage.

To the northeast, a more continental climate is evident, and PSME/SPBE merges with the Douglas-fir/pinegrass and Douglas-fir/common juniper habitat types. Both of these types occupy more severe sites than the PSME/SPBE h.t., which often occupies the more favorable topographic positions in this area. Substrates are more varied, including quartzite, andesite, dacite, quartz monzonite, and occasionally granitics. Consequently, the PSME/SPBE h.t. is more variable in eastern portions of its distribution than elsewhere in central Idaho.

The PSME/SPBE h.t. ranges in elevation from about 3,300 to 8,100 feet (1,006 to 2,469 meters). This broad range is segmented elevationally and geographically by three phases. Elevational range and occurrence of tree species in the various phases are shown in table 1. Geographic differences are outlined in table 2.

Pinus ponderosa (PIPO) Phase

The PIPO phase occurs mainly in western portions of central Idaho (fig. 1) and extends into northern Idaho and western Montana (table 2). It is found mostly in the Boise, Payette, and Weiser River drainages where it ranges from about 3,300 to 6,600 feet (1,006 to 2,017 meters) in elevation and represents the warm, low-elevation extremes of the habitat type. The potential to support naturally established ponderosa pine is the diagnostic characteristic of this phase.

Because the environment of this phase is the most moderate of the three phases, it supports the greatest

Table 2—Phase designations of the PSME/SPBE h.t. suggested by various studies

Defined phases	Eastern Oregon (Johnson and Simon 1987)	Northern Idaho (Cooper and Others 1991)	Western Montana (Pfister and Others 1977)	Central Idaho (Steele and Others 1981)	Eastern Idaho, Western Wyoming (Steele and Others 1983)
None	X[1]	X	X	—	—
PIPO	O	O	O	X	—
CARU	—	—	—	X	X
SPBE	—	—	O	X	X

[1]X = phase defined; O = phase suggested by data or text.

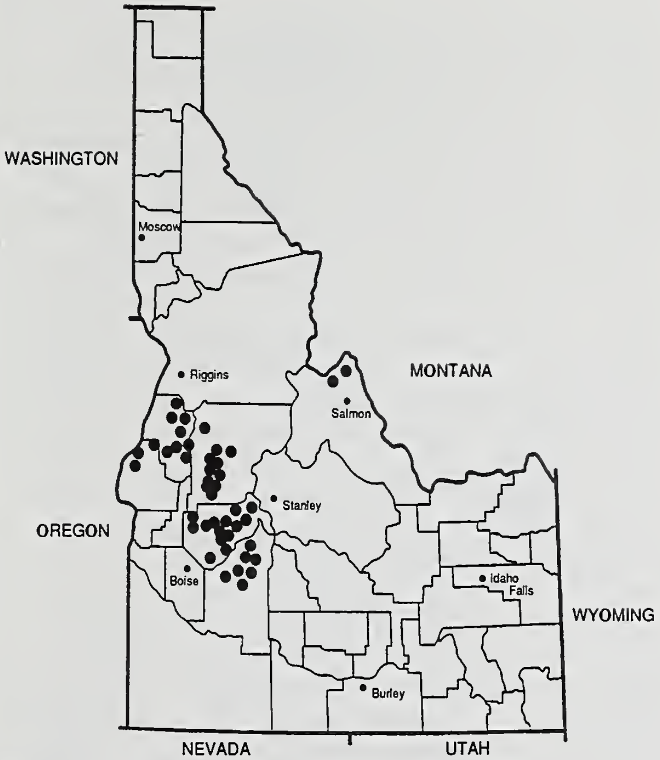

Figure 1—Distribution of the PSME/SPBE h.t., PIPO phase in central Idaho.

number of species. These species are most evident in early seral communities. Early seral conditions support few naturally established trees, but most of these sites have been planted to *Pinus ponderosa* with varying degrees of success. Plantations of *Pseudotsuga menziesii* have mostly failed. Unlike some other habitat types, *Populus tremuloides* only occasionally develops a tree layer in the PSME/SPBE h.t. Where *Populus* communities have been found, the sites are usually transitional to some other habitat type containing finer textured soils or more moisture. Likewise, *Pinus contorta* is usually restricted to sites that accumulate more cold air than normal in the PSME/SPBE h.t. Generally these sites are transitional to a cooler habitat type. Consequently, tree layer succession on most sites in the PIPO phase is relatively simple, consisting mainly of ponderosa pine and Douglas-fir. Early seral shrub layer conditions are characterized mainly by *Purshia tridentata* or *Ceanothus* spp.; occasionally *Artemisia tridentata* or *Ribes* spp. are well represented. The *Purshia* or *Ribes* result mainly from scarification; *Ceanothus* responds mainly to burning but can respond to scarification, though to a lesser degree. The *Artemisia* invades bare soil exposed by burning or scarification. Unless the site has been intensively burned or scarified, *Spiraea betulifolia* soon dominates these early seral shrub layers. Its deep root system and rhizomatous growth habit enable *Spiraea* to survive most disturbances and increase rapidly. Certain herbaceous species also indicate early seral conditions. *Bromus carinatus*, *Potentilla glandulosa*, or assorted annuals such as species of *Bromus*, *Epilobium*, *Galium*, and *Gayophytum* may become well represented after a severe disturbance. High coverages of *Bromus carinatus* generally occur on scarified sites that receive little or no grazing. The *Potentilla* responds mainly to scarification without burning on either grazed or ungrazed sites. Assorted annuals (appendix B-1) may appear following severe burning or scarification; their presence, along with *Potentilla*, is often prolonged by the yearly disturbances of grazing.

Mid- to late-seral conditions generally support a large complement of ponderosa pine that provides the shelter often needed for Douglas-fir establishment on these sites. As shade from the pine canopy increases, the shrub layer changes. The shade-intolerant shrubs, *Artemisia*, *Purshia*, *Ceanothus*, and *Ribes*, decline, leaving the more tolerant *Salix scouleriana* or *Prunus* spp. as indicators of midseral stages. Neither of these species can persist indefinitely as the denser Douglas-fir canopy achieves dominance. Consequently, the shrub layer becomes shorter and less diverse toward climax. In the herbaceous layer, the early seral species decline substantially with increased shade. More shade-tolerant taxa such as *Geranium viscosissimum* and *Apocynum androsaemifolium* may persist and serve as indicators of mid- to late-seral conditions. Climax taxa such as *Calamagrostis rubescens* and *Arnica cordifolia*, both of which spread by rhizomes, may already be dominating these midseral associates.

As stands approach climax, Douglas-fir is the dominant tree, often forming pure stands. However, low coverages of ponderosa pine may persist due to that species' greater height and long lifespan. Shrub layers become increasingly simple, consisting mainly of *Symphoricarpos oreophilus*, *Amelanchier alnifolia*, and *Spiraea*. Only the *Spiraea* is rhizomatous; its vegetative reproduction allows it to dominate the shrub layer. The number of species in the herbaceous layer also decreases. The layer consists mainly of *Lupinus* spp. and shade-tolerant rhizomatous species. *Aster conspicuus*, *Carex geyeri*, *Arnica cordifolia*, *Calamagrostis rubescens*, and *Thalictrum occidentale* are the primary species found in near-climax herb layers.

Before the advent of fire control, these areas were maintained in midseral condition by low-intensity surface fires occurring every 10 to 20 years (Steele and others 1986). The larger *Pinus ponderosa* generally survived the fires, forming open stands

(fig. 2). The *Salix* and *Prunus* would resprout after each fire along with *Geranium* and *Apocynum*. The near-climax species noted above would also resprout. Because the fires were of low intensity, they generally did not create extensive areas for early seral species to establish. But scattered patches of *Ceanothus*, *Ribes*, and *Artemisia* could appear wherever concentrations of fuel resulted in higher fire intensity. Stands maintained in this condition by frequent surface fires were quite resistant to less frequent stand-destroying fires. Wide spacing made the pines resistant to bark beetle attack. The underburning also killed the lower limbs of surviving trees, reducing the chance of mistletoe infection. This scenario falls within Fire Group Three described by Crane and Fischer (1986).

Calamagrostis rubescens (CARU) Phase

The CARU phase occurs mainly in the Salmon River drainage between the towns of Stanley and Salmon; it is a minor phase in eastern Idaho (fig. 3). The main distribution largely coincides with that of a major pinegrass zone and a core area of the Douglas-fir/pinegrass habitat type, pinegrass phase in central Idaho. The CARU phase in general represents a transition between the Douglas-fir/white spirea and Douglas-fir/pinegrass habitat types. These sites range from 6,000 to 7,900 feet (1,829 to 2,408 meters) in elevation and appear to be too cool for *Pinus ponderosa* to establish naturally. *Pinus contorta* may occur as a major seral species where cold air accumulates. Elsewhere in this phase, *Pseudotsuga menziesii* is the only major tree species.

Early seral conditions are usually dominated by shrubs in the CARU phase. However, these shrub layers are less diverse and more poorly developed than in the PIPO phase due to the cooler growing conditions. *Artemisia tridentata* ssp. *vaseyana* often invades bare soil exposed by burning or scarification. *Ceanothus velutinus* germinates from buried seed following burning, and occasionally scarification, but does so only on the warmer sites lacking frost pockets. *Ribes cereum*, and sometimes *R. viscosissimum*, appear following scarification. The *Ribes cereum* usually grows in a tall vase-shaped form as opposed to its more widespread rounded form. All of these shrubs are indicative of early seral conditions, yet seldom do they achieve densities comparable to those reached in the warmer PIPO phase. Early seral herbaceous layers may have a large number of species, and these species may have high coverages. *Potentilla glandulosa*, and

Figure 2—A stand of *Pinus ponderosa* on a PSME/SPBE h.t. northeast of Lowman, ID, in 1980. Several fires have burned through this stand, maintaining the open parklike condition that was common in this habitat type prior to fire control.

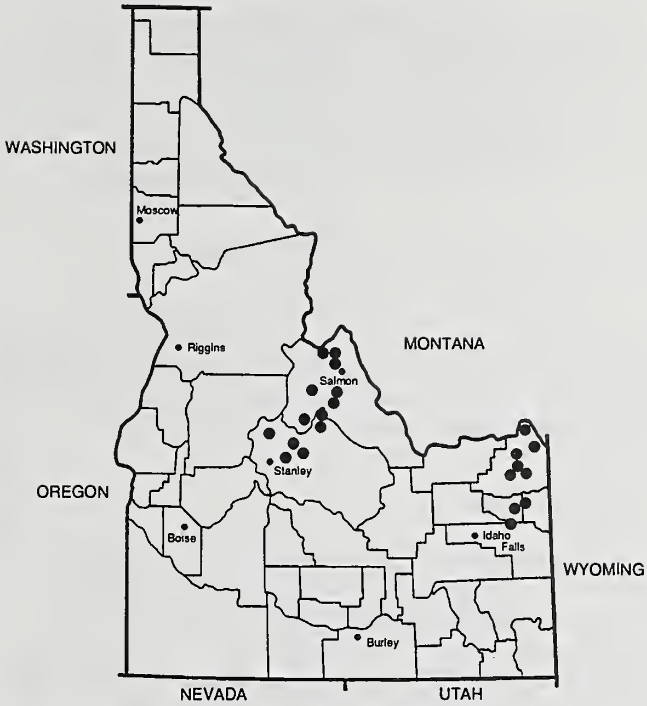

Figure 3—Distribution of the PSME/SPBE h.t., CARU phase in Idaho.

occasionally *Carex rossii*, germinate from buried seed following scarification. These two species, along with an assortment of annuals, indicate early seral conditions. Unless the disturbance is severe, *Calamagrostis* usually dominates the herb layer.

Midseral conditions may support a stand of *Pinus contorta*. Otherwise, gradual recruitment of *Pseudotsuga* shades out the *Artemisia*, *Ceanothus*, or *Ribes* and leaves *Salix* or *Prunus* as the midseral shrub indicator. By this time *Spiraea* usually has the greatest shrub coverage. Herbaceous layers decline in diversity, but coverages may remain high, as *Calamagrostis* and *Arnica* continue to increase by rhizomes. *Apocynum androsaemifolium* and *Lupinus* spp. persist in the undergrowth, serving as indicators of midseral conditions.

Late-seral to near-climax conditions are relatively simple. *Pseudotsuga menziesii* is the dominant tree and often the only tree species present. *Symphoricarpos oreophilus* may remain well represented and is slowly declining. *Spiraea*, and *Pachistima myrsinites* in some areas of eastern Idaho, are the only shrub species that are well represented as the stands near climax. Usually *Spiraea* displays a rather uniform coverage throughout the stand. *Calamagrostis* and *Arnica* are conspicuous throughout the herb layer. All other herb layer species are poorly represented.

The CARU phase is considered part of Fire Group Four by Crane and Fischer (1986). Fire generally occurs less frequently here than in the PIPO phase. Because these cooler sites produce less understory fuels, fires may still behave as low-intensity surface fires even though they occur less frequently. These fires thin out small *Pseudotsuga* and maintain a low-density stand resistant to bark beetles. The open tree canopy permits midseral shrub and herb layer species to persist in the undergrowth. The fires also help control mistletoe by scorching and killing the lower branches of large trees. Wherever the fires encounter heavier ground fuels, such as fallen trees, a seedbed is prepared for early and midseral species, including *Pinus contorta*. On some sites, *Pseudotsuga* creates dense stands of small trees. These areas are more vulnerable to bark beetles and stand-destroying fires.

Spiraea betulifolia (SPBE) Phase

The SPBE phase occurs to the east of, or at elevations above, the PIPO and CARU phases (fig. 4). In general, it represents the most severe sites within the PSME/SPBE h.t. It ranges in elevation from about 6,500 to 8,100 feet (1,981 to 2,469 meters). The SPBE phase tends to occur on sites unsuitable for good *Calamagrostis* development but may occur near the CARU phase. In general, the SPBE phase

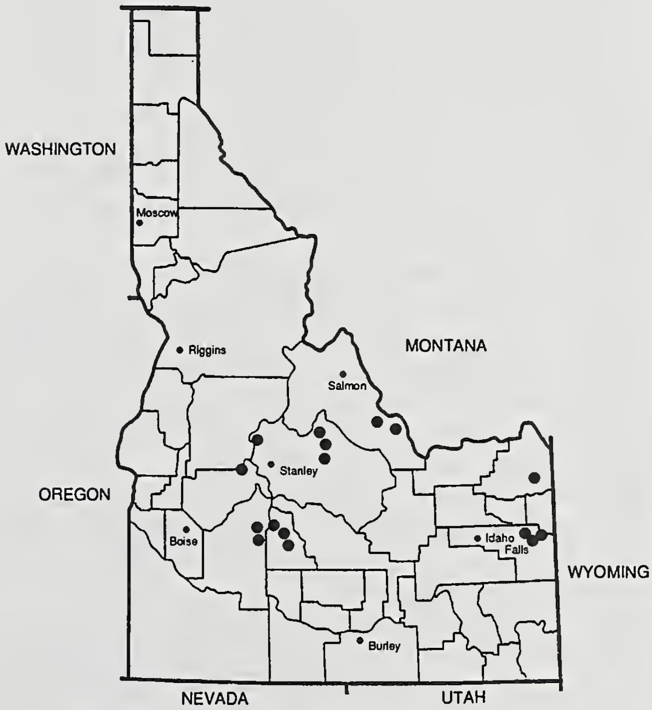

Figure 4—Distribution of the PSME/SPBE h.t., SPBE phase in Idaho.

is distributed over much of the same area as the Douglas-fir/elk sedge habitat type, elk sedge phase, often merging with that habitat type on these sites. In some areas, the SPBE phase commonly merges with the Douglas-fir/Oregon grape habitat type; occasionally, it merges with the Douglas-fir/common juniper habitat type. *Pinus contorta* may occur here as a minor seral species, but usually *Pseudotsuga* is the only tree to dominate the site. *Populus tremuloides* may occur in small amounts but rarely dominates.

Early seral conditions often support a poorly developed shrub layer. Occasional *Artemisia* and *Chrysothamnus* may establish wherever bare soil exists. Scattered *Ribes* spp. may germinate from buried seed following scarification and occasionally following burning. On the warmer sites *Ceanothus velutinus* may appear following burning, but its coverage is apt to be low and scattered. On the cooler sites scattered *Shepherdia canadensis* may appear following burning. Unless the site is severely disturbed, *Spiraea* usually maintains the highest coverage. Early seral herbaceous layers are usually characterized by *Potentilla glandulosa* or *Bromus carinatus* from scarification and *Iliamna rivularis* from severe burning. An assortment of annuals and biennials such as *Collomia*, *Collinsia*, and *Lactuca* may also appear on the bare soil.

Midseral stages may support a few *Pinus contorta* and scattered sapling-size *Pseudotsuga*. Rarely does *Pinus contorta* dominate these sites; most *Pseudotsuga* establish sporadically in the protected microsites of taller shrubs. *Prunus virginiana*, and occasionally *Prunus emarginata*, are indicative of midseral shrub layer conditions. The taller canopies of these shrubs help to ameliorate site conditions. Midseral herbaceous layers are characterized mainly by *Geranium viscosissimum*. The climax species, *Arnica cordifolia* and *Carex geyeri*, usually increase beneath the shrubs.

Late seral to near-climax conditions are relatively simple, as they are in the CARU phase. *Pseudotsuga menziesii* is the dominant tree and often the only tree species in the stand. *Symphoricarpos oreophilus* and *Amelanchier* remain well represented beneath the *Pseudotsuga* as late seral shrub species. *Spiraea*, and in some areas *Pachistima*, are the only shrubs that are well represented. The herbaceous layer has declined, leaving *Carex*, *Arnica*, and occasionally *Thalictrum* as the only herbs well represented in the undergrowth.

The SPBE phase also falls within Crane and Fischer's (1986) Fire Group Four. Burning patterns are similar to the CARU phase but are influenced by the lack of *Calamagrostis*. Without a grass cover, the *Pseudotsuga* can regenerate more easily, developing dense stands that increase the risk of a stand-destroying fire. The lack of grass impedes low-intensity fires that could thin the stand and reduce fuels. On some sites, a layer of *Carex geyeri* helps compensate for the lack of *Calamagrostis*, increasing the likelihood of low-intensity fires.

SUCCESSIONAL FEATURES

A systematic classification of seral vegetation within the PSME/SPBE h.t. was developed as part of this study. The approach (Steele 1984) recognizes the two primary factors affecting vegetal change: time and the environment.

Classification

Environmental variation has been categorized by the habitat type classification system (Steele and others 1981). The habitat type system uses indicator species based on their ability to dominate or at least maintain their population at climax. The relative value of a species as an environmental indicator is inversely related to its relative environmental amplitude. In other words, species with the most restricted environmental distributions are the best indicators of specific habitat conditions.

Temporal (successional) variation within habitat types can be categorized by a comparable system that uses indicator species based on their ability to dominate, or at least be well represented, in a particular seral stage. This system of classification depends on a species' relative successional amplitude (competitive ability), which is also inversely related to its indicator value. In other words, the species with the least competitive ability that is well represented is the best indicator of a specific successional condition.

Seral indicator species in a given habitat type can be arranged along the successional gradient according to their relative successional amplitudes. Figure 5 shows this arrangement for the major tree species in the PSME/SPBE h.t. These indicators are then combined with possible dominant species to provide a temporal-structural framework for classifying seral vegetation. Figure 6 shows the classification framework derived from figure 5. Shade tolerance is often assumed to be the factor that determines successional amplitude, but, as Minore (1979) suggests, other factors may be involved. Bazzaz (1979) addresses numerous physiological factors affecting a plant's ability to compete with its associates. A species' longevity, its nutrient requirements, allelopathic and disease resistance, reproductive strategy, and the quality of the light it receives are some of the factors involved. Fortunately, the integrated

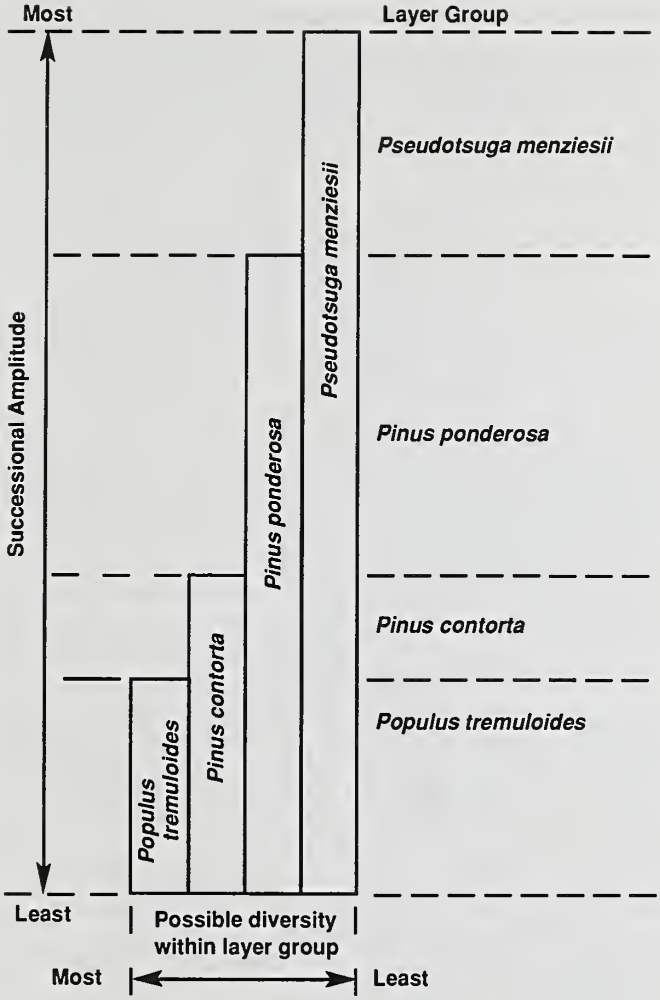

Figure 5—Relative successional amplitudes of major tree species in the PSME/SPBE h.t.

effects of all competitive factors, known or unknown, can be interpreted through relative successional amplitudes. They in turn provide a successional time scale for classification purposes. In contrast, classifying seral communities by the years since disturbance is untenable due to the randomness of successional forces such as seed crops, insect attacks, disease, and weather.

The Tree Layer

The tree, shrub, and herb layers follow partially independent successional patterns and may be affected by layer-specific disturbance; therefore, this classification focuses on the individual layers. The tree layer (trees more than 4.5 feet [1.4 meters] tall) is relatively simple to classify in the PSME/SPBE h.t. because it contains only four major species. The relative successional amplitudes of these species are shown in figure 5. *Populus tremuloides* is clearly less shade tolerant than the associated conifers. *Pinus contorta* has less amplitude than *P. ponderosa* (fig. 5), even though *P. contorta* is more shade tolerant (Minore 1979). *Pinus contorta* has a shorter life span and does not grow as tall as *P. ponderosa.* Thus, *P. contorta* is not likely to maintain itself beneath *P. ponderosa* without disturbance to reduce the young *Pseudotsuga* that will accumulate in the understory. Nor will *Pinus ponderosa* seedlings survive beneath the denser canopy of *Pseudotsuga.* Once the older pines in the stand have declined, another successional segment is delineated. The passing of each of these species marks a segment in the

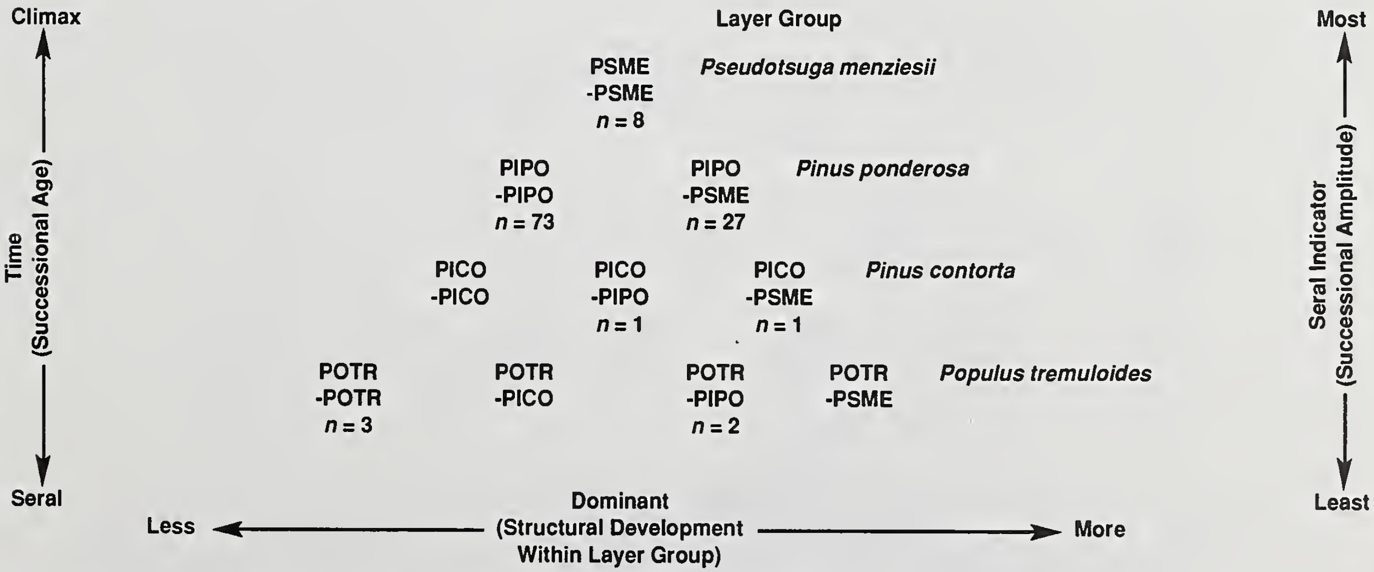

Figure 6—Succession classification diagram of the tree layer in the PSME/SPBE h.t., PIPO phase (*n* = number of samples in each layer type).

successional sequence. *Pseudotsuga*, being the most shade tolerant, has the greatest successional amplitude and acts as the climax tree. Although various factors often preclude the entire replacement sequence, the relative successional amplitudes have been established for use in classification.

Figure 5 suggests that the greatest diversity in the tree layer is possible during the early seral stages when all four species could be present on the site. This is usually not the case. In the climax stage, however, only *Pseudotsuga* will be well represented, with all other tree species poorly represented or absent. Diminishing diversity becomes more apparent in the shrub and herb layers where more species occur.

Figure 6 shows the various seral conditions in the tree layer that may converge to a common climax community of *Pseudotsuga. Populus tremuloides* forms the base of the triangle, because it has the least successional amplitude. Other species are arranged in ascending order as a reflection of their progressively greater successional amplitudes. No single attribute, such as relative shade tolerance (Minore 1979), corresponds directly with all successional amplitudes. Relative amplitudes reflect the integrated effects of all autecologic attributes influenced by succession.

In order to maintain a systematic taxonomic structure, each unit in figure 6 is called a layer type. Each group of layer types having the same seral indicator is called a layer group. Layer groups denote the various seral stages that are possible within a given habitat type or phase. Layer types within one layer group, such as PIPO-PIPO and PIPO-PSME in the PIPO layer group, denote the various species that may dominate in that particular seral stage. These conditions may result from natural establishment of tree seedlings or from tree plantations that often result in a given layer type (especially PIPO-PIPO). Similar classifications were developed for the shrub and herb layers. If desired, taxonomy of the tree, shrub, and herb layers can be combined to characterize the entire plant community.

Figure 7 shows the tree layer types that occur under natural conditions in the CARU phase. In the SPBE phase only *Pseudotsuga* is well represented, so the only tree layer type is PSME-PSME (fig. 8). Because the CARU and SPBE phases are found in more severe environments than the PIPO phase, they have fewer tree species well represented and consequently, fewer tree layer types. The CARU and SPBE phases occupy less area than the PIPO phase and experience considerably less management activity. Consequently, data are insufficient to develop complete management implications for these two phases. However, management implications for the CARU phase of the Douglas-fir/pinegrass h.t. (Steele and Geier-Hayes 1993) are likely to apply to the CARU phase of the PSME/SPBE h.t. Guidelines developed for the Douglas-fir/elk sedge h.t. (Steele and Geier-Hayes 1987a) are likely to apply to the SPBE phase.

Delineating the vertical axis (successional time) into layer groups (fig.6) provides an ecological basis for segmenting succession. As succession progresses, a stand's classification status should progress from one layer group to a successionally older layer group. For instance, *Pinus ponderosa* (well represented) may dominate the tree layer (PIPO-PIPO) or may be dominated by *Pseudotsuga*

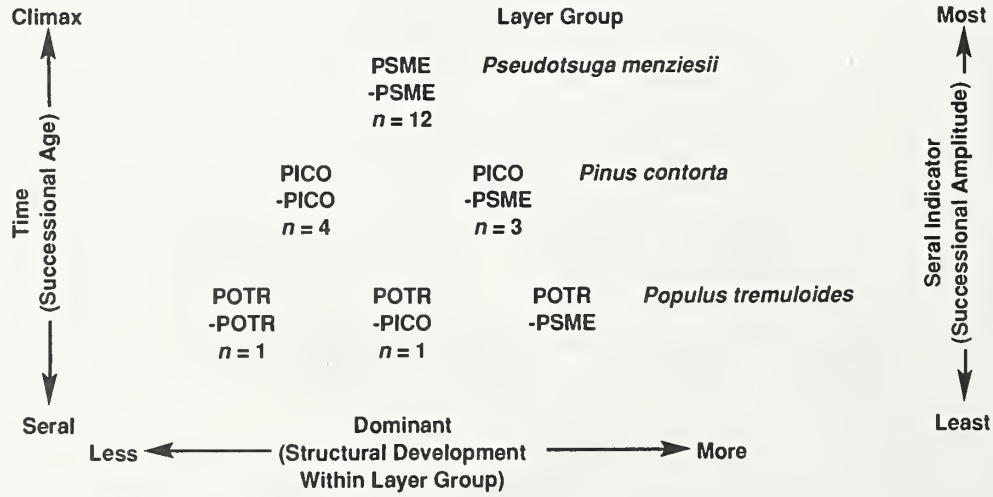

Figure 7—Succession classification diagram of the tree layer in the PSME/SPBE h.t., CARU phase (*n* = number of samples in each layer type).

Climax

Seral

Layer Group

PSME -PSME $n = 13$ — *Pseudotsuga menziesii*

Figure 8—Succession classification diagram of the tree layer in the PSME/SPBE h.t., SPBE phase (n = number of samples in the layer type).

(PIPO-PSME). But the presence of *Pinus ponderosa* can always be interpreted as a specific segment of the succession, because it always has the potential to be outcompeted by *Pseudotsuga*. *Pinus ponderosa* is unable to replace *Pseudotsuga* without the aid of disturbance, but can outcompete *Pinus contorta* or *Populus tremuloides*.

Figure 6 serves as a classification diagram (not a successional model) for seral tree layers in the PSME/SPBE h.t. Diagrams in this report do not outline actual successions for a given site but illustrate the possibilities within the habitat type. Some layer types are more common than others; actual successions skip many layer types and even layer groups within the respective diagrams. A succession can be described in terms of the layer types shown but is determined by the species composition of a given stand and by the available seed sources.

Figure 6 also serves as a basis for constructing a simple field key to tree layer types. The key starts with the earliest layer group in figure 6, progressing along the succession gradient to climax (table 3). Keys to the shrub and herb layer types are constructed in the same way. These keys are intended to be used in the same manner as the habitat type keys (Pfister and others 1977; Steele and others 1981).

SIZE CLASS NOTATIONS

The basic classification approach used in the tree, shrub, and herb layers is presented in figures 5 and 6 and table 3. The tree layer also progresses through recognizable size classes, such as sapling (0.1-4 inches, 0.25-10.2 centimeters diameter at breast

Table 3—Key to tree layer groups and layer types, with codes, in the PSME/SPBE h.t.

			Code No.
1.	*Populus tremuloides* well represented[1]	POTR LAYER GROUP	014
1a.	*Populus tremuloides* dominant	POTR-POTR Layer Type	014.014
1b.	*Pinus contorta* dominant or codominant	POTR-PICO Layer Type	014.010
1c.	*Pinus ponderosa* dominant or codominant	POTR-PIPO Layer Type	014.013
1d.	*Pseudotsuga menziesii* dominant or codominant	POTR-PSME Layer Type	014.016
1.	*P. tremuloides* poorly represented	2	
2.	*Pinus contorta* well represented	PICO LAYER GROUP	010
2a.	*Pinus contorta* dominant	PICO-PICO Layer Type	010.010
2b.	*Pinus ponderosa* dominant or codominant	PICO-PIPO Layer Type	010.013
2c.	*Pseudotsuga menziesii* dominant or codominant	PICO-PSME Layer Type	010.016
2.	*P. contorta* poorly represented	3	
3.	*Pinus ponderosa* well represented	PIPO LAYER GROUP	013
3a.	*Pinus ponderosa* dominant	PIPO-PIPO Layer Type	013.013
3b.	*Pseudotsuga menziesii* dominant or codominant	PIPO-PSME Layer Type	013.016
3.	*P. ponderosa* poorly represented	4	
4.	*Pseudotsuga menziesii* well represented	PSME LAYER GROUP	016
4a.	*Pseudotsuga menziesii* dominant	PSME-PSME Layer Type	016.016
4.	*P. menziesii* poorly represented	depauperate or unclassified layer type	

[1]"Well represented" means vertical canopy coverage ≥5 percent of the land area regardless of diameter classes of the trees involved. Trees less than 4.5 feet (1.4 meters) tall should be omitted from coverage estimates. "Dominant" refers to greatest canopy coverage; "codominant" refers to nearly equal canopy coverage. First go through the key to select the appropriate layer group, then key to layer type. When keying to layer type, choose first condition that fits.

height [d.b.h.]), pole (4-12 inches, 10.2-30.5 centimeters), mature (12-18 inches, 30.5-45.7 centimeters), and old (greater than 18 inches or 45.7 centimeters). These notations are best added to each tree species after the tree layer type (l.t.) is identified, such as Mature PIPO-Sapling PSME l.t. For consistency the smallest size class that is well represented should be noted for the successional indicator, because it reflects a species' regeneration capability. For the dominant species, the dominant size class should be used. When the indicator species is well represented in the stand but not in any one size class, or when the dominant species does not have a dominant size class, the size class with the most coverage should be noted. For convenience, size class notations can be abbreviated as follows: S. for sapling, P. for pole, M. for mature, and O. for old.

It may be difficult at first to visualize some tree layer types in their appropriate successional position. For instance, an S. PSME-S. PSME l.t. may not seem to be successionally older than an M. PICO-S. PSME l.t., because we normally think in terms of chronological age. On a successional scale, however, a pure stand of sapling *Pseudotsuga* is closer to climax than a mixed older stand of *Pinus contorta* and *Pseudotsuga*; it will not have to go through the earlier successional stages of the PICO and PIPO layer groups. In fact, an S. PSME-S. PSME l.t. may reach climax in fewer years, because no species replacement (succession) is needed. An M. PICO-S. PSME l.t. must first lose the *Pinus contorta*, and if *Pinus ponderosa* is well represented, must also pass through a PIPO-PSME l.t. before reaching climax.

The four possible tree layer groups in the PSME/SPBE h.t. (fig. 6) delineate tree layer succession into relatively broad segments. Since layer groups are usually delineated by a single indicator species, their origin can be related to a somewhat consistent set of site conditions. However, progression from one layer group to another (and one layer type to another) depends on the composition and structure of the individual stand and can be predicted only from field observation. The following layer group descriptions are presented in the order in which they appear in the key (table 3).

POPULUS TREMULOIDES LAYER GROUP (POTR L.G.)

Populus tremuloides can establish by seed on newly exposed mineral soil that remains moist during the critical germination period. Viability of freshly fallen seed usually exceeds 90 percent, but seeds remain viable only for about 3 weeks (Brinkman and Roe 1975). Occasional *Populus* seedlings have established in well-scarified areas, some in areas drier than the PSME/SPBE h.t. Usually the young trees occur as root suckers following fire or logging. Where sunlight is available, large *Populus* can be cut to produce suckers that are excellent forage for deer and elk.

The POTR l.g. consists of four possible layer types (fig. 6). These layer types usually result from the suckers of scattered, often decadent, *Populus* after the overstory has been removed by wildfire or logging. When *Populus* is present in the stand and no conifers establish soon after disturbance, a POTR-POTR layer type can result (fig. 9). In this layer type, subsequent invasion by conifers may be slow even when seed sources are nearby. Reasons for this are unclear, but Younger, and others (1980) have shown that *Populus tremuloides* leaf litter can chemically inhibit seedling growth of several grasses. Possibly conifer seedlings are also affected. Since the POTR-POTR layer type creates only light shade, it allows lush development of the herb layer, which also hinders conifer establishment. Simultaneous establishment of *Pinus contorta*, *P. ponderosa*, or *Pseudotsuga* when scattered *Populus* resprout can produce a POTR-PICO, POTR-PIPO, or POTR-PSME layer type. All of these can progress to a pine or Douglas-fir layer group more quickly than the POTR-POTR layer type.

PINUS CONTORTA LAYER GROUP (PICO L.G.)

Pinus contorta occurs infrequently in the PSME/SPBE h.t. It is most common in cooler portions of the h.t., mainly in areas where the CARU phase is found. Such sites often receive cold-air drainage and occur mostly on benches or lower slopes where frost potential is considerably higher than the average for surrounding areas. Areas dominated by *Pinus contorta* generally indicate a frost pocket condition, and *P. contorta* is usually the tree species most capable of regenerating the site. Historically, severe wildfires were the cause of the PICO l.g.; more recently, clearcuts with burning or scarification treatments have produced a similar result. *Pinus contorta* regenerates easily in full sun whenever bare soil and an adequate seed source exist. Plantings of *P. contorta* establish with relative ease and have created PICO layer types on many sites. These plantations often extend upslope beyond the cold air zone that creates the natural site for this species. *Pinus contorta* seedlings often survive and grow under these warmer "offsite" conditions but are apt to produce less timber than *Pseudotsuga*. Such plantings may provide shelter for *Pseudotsuga* seedlings and hasten succession toward a PICO-PSME, and ultimately, a PSME-PSME layer type (fig. 6).

The PICO l.g. consists of three layer types in PSME/SPBE (fig. 6). The PICO-PICO and PICO-PSME layer types appear mainly in the CARU phase where *P. contorta* is a major seral species

Figure 9—A sapling POTR-pole POTR tree layer type northeast of Idaho City, ID, in 1985. The area burned in 1934 destroying any conifers that may have existed there. *Populus* was probably present before the fire and resprouted afterward. Although a *Pinus ponderosa* seed source was within 80 yards (73 meters), no conifers were in the stand.

(table 1). Because *P. contorta* is a minor seral species in the PIPO phase, the PICO-PIPO layer type is rare; it can develop naturally on the cooler sites in the PSME/SPBE h.t. or from mixed plantings of *P. contorta* and *P. ponderosa*. PICO layer types represent early seral stages of the tree layer and often occur as sapling- or pole-size stands following burning or scarification in the CARU phase. The short-lived nature of *P. contorta* allows this layer group to be replaced in a relatively short time. Unless disturbed, most of the stands we sampled in the PICO l.g. will progress to the PSME l.g. within one generation of *P. contorta*. However, sites in more severe frost pockets may go through two or more generations of *P. contorta* before progressing to a PSME layer type.

PINUS PONDEROSA LAYER GROUP (PIPO L.G.)

Pinus ponderosa is the only major seral tree species found throughout the PIPO phase, yet it seldom colonizes recent clearcuts. Poor dispersion of the heavy seed and unsuitable seedbeds limit ponderosa pine regeneration. Distance to seed source and infrequent cone crops are often responsible for a scarcity of seed. Logging and burning stimulate several shrub and herb layer species that can quickly dominate potential pine seedbeds. As a result, natural establishment of *P. ponderosa* in large clearcuts is often slow and sporadic. Well-scarified or underburned sites with a light canopy of seed-producing pines will often regenerate a PIPO layer type.

The PIPO l.g. consists of two layer types: PIPO-PIPO and PIPO-PSME. These layer types represent midseral conditions (fig. 6), even though they are usually the initial tree layer on the site. Historically, the PIPO-PIPO layer type resulted from frequent low-intensity wildfires that killed mainly *Pseudotsuga* (Steele and others 1986). More recently, pine plantations are creating the same layer type. The PIPO-PSME layer type is common wherever stands have escaped burning for 50 years or more. Consequently, much of the historic PIPO-PIPO layer type has recently progressed to PIPO-PSME

(fig. 10). Today this is probably the most common tree layer found in the PSME/SPBE h.t., PIPO phase. The usual size classes are O. PIPO-P. PSME. In some cases, selective cutting of the pine has quickly advanced succession to the PSME l.g. and increased insect and disease hazards for the overall stand.

PSEUDOTSUGA MENZIESII LAYER GROUP (PSME L.G.)

Pseudotsuga is the only tree species that occurs throughout the range of the PSME/SPBE h.t. On most sites *Pseudotsuga* establishment is slow and sporadic. Established seedlings often appear to have benefited from protection of seedling microsites. Rocks, logs, shrubs, and tree canopies all provide microsite protection. Most stands of *Pseudotsuga* have apparently established naturally under the shelter of other trees or shrubs. Established plantations of *Pseudotsuga* have not yet been found in the PSME/SPBE h.t.

Since the PSME l.g. is climax, it consists of only one layer type, PSME-PSME. Though scarce in the PIPO phase, the PSME-PSME layer type is quite common in the CARU and SPBE phases. In these phases it is often the only tree layer occurring naturally and may be in all size classes. Regardless of tree size, the PSME-PSME layer type is considered closest to climax on a successional scale. Compared to other tree layer types in the PSME/SPBE h.t., PSME-PSME has the greatest hazard potential for catastrophic fire, spruce budworm, and dwarf mistletoe. Generally the seral tree species are more desirable in terms of maintaining a healthy stand.

The Shrub Layer

Shrub layer succession is more diverse and more difficult to interpret than tree layer succession, because more species are involved. Environmental variation within the habitat type also contributes to this diversity. The dry extreme of the PSME/SPBE

Figure 10—An old PIPO-pole PSME tree layer type on Hitt Mountain west of Cambridge, ID, in 1980. The dominant tree layer shows that this was once an open stand of *Pinus ponderosa*. It has not burned for about 90 years. A dense layer of *Pseudotsuga* has accumulated in the understory, creating conditions conducive to a stand-destroying fire.

h.t., PIPO phase usually merges with the Douglas-fir/elk sedge (PSME/CAGE) habitat type, and the moist extreme merges with Douglas-fir/ninebark (PSME/PHMA) or Douglas-fir/mountain maple (PSME/ACGL). Shrub layer succession near these extremes often resembles that of the adjacent site.

The 199 shrub layers sampled in the PSME/SPBE h.t. include nine major successional species and seven alternates (table 4). Some major species also serve as alternates in a different phase of the PSME/SPBE h.t. The alternate species often occur in only part of the habitat type; for classification purposes they are grouped with more widespread species having similar successional strategies and amplitudes. For instance, *Ceanothus sanguineus* and *Shepherdia canadensis* were grouped with *C. velutinus* because all three species have similar seed storage capabilities and responses to burning, and because they persist only to a limited extent beneath a partial tree canopy. *Symphoricarpos oreophilus* is grouped with *Amelanchier alnifolia* because both species are disseminated mainly by rodents and birds, are nonrhizomatous, and can persist beneath a moderately dense tree canopy. *Artemisia tridentata* is grouped with *Purshia tridentata*, because both species tend to colonize bare mineral soil, are nonrhizomatous, and have the least shade tolerance of all shrubs in this group. A few other taxa such as *Rubus parviflorus* and *Philadelphus lewisii* were only occasionally well represented; therefore, they were not used for classification.

The relative successional amplitudes of major shrub species in PSME/SPBE provide the basis for shrub layer classification; they are shown in figure 11. These amplitudes were derived from many field observations and sample data (appendix A). They are meaningful only in a relative sense, since there is no scale for measurement. Ideally, relative amplitudes should be established through studies of many permanent plots over many decades. Such studies are rarely attempted. Consequently, the accuracy of relative amplitudes varies from well-established trends to the authors' best guess. The accuracy is greatest for the species farthest apart (fig. 11). For example, *Artemisia* and *Purshia* clearly have less successional amplitude than *Spiraea* (fig. 11), but the relative amplitude of *Salix* when compared to *Prunus* is less certain.

From the relative amplitudes (fig. 11), succession classification diagrams for shrub layers are easily constructed (figs. 12, 13, 14). For instance, the PIPO phase (fig. 12) consists of seven shrub layer groups and 28 layer types. Of the 28 possible layer types, 21 occur in the present data set (fig. 12). The remaining layer types eventually may be found following uncommon disturbances (or combinations of different kinds of disturbance) or may be rare under any circumstance.

The classification diagrams (figs. 12, 13, 14) are easily converted to systematic keys for field use (tables 5, 6). Layer group indicator species appearing early in the key have the least successional

Table 4—Successional roles and maximum heights of major shrub species in phases of the PSME/SPBE h.t.

Code No.	Species	Height (ft)	Phase PIPO	Phase CARU	Phase SPBE
105	*Amelanchier alnifolia*	6-8	LS[1]	(ls)	—
150	*Artemisia tridentata*	2-3	a	ES	ES
198	*Ceanothus sanguineus*	4-5	(S)	—	—
107	*Ceanothus velutinus*	3-5	ES	(ES)	—
108	*Chrysothamnus nauseosus*	2-3	ES	ES	ES
152	*Chrysothamnus viscidiflorus*	2-3	—	es	ES
118	*Pachistima myrsinites*	1-2	—	(C)	(C)
123	*Prunus emarginata*	4-8	(MS)	—	—
124	*Prunus virginiana*	4-8	MS	(ms)	—
125	*Purshia tridentata*	2-3	ES	(ES)	(es)
128	*Ribes cereum*	2-3	ES	ES	(ES)
131	*Ribes viscosissimum*	2-3	es	(ES)	a
137	*Salix scouleriana*	10-14	MS	(MS)	a
139	*Shepherdia canadensis*	2-4	(es)	(ES)	(ES)
142	*Spiraea betulifolia*	1-2	C	C	C
163	*Symphoricarpos oreophilus*	2-4	LS	LS	LS

[1]a = accidental; C = climax; ES = early seral; LS = late seral; MS = midseral; lower case letters = minor occurrence; upper case letters = major occurrence; ( ) = occurs in only part of the phase, usually the moister portion or the warmer-drier portion.

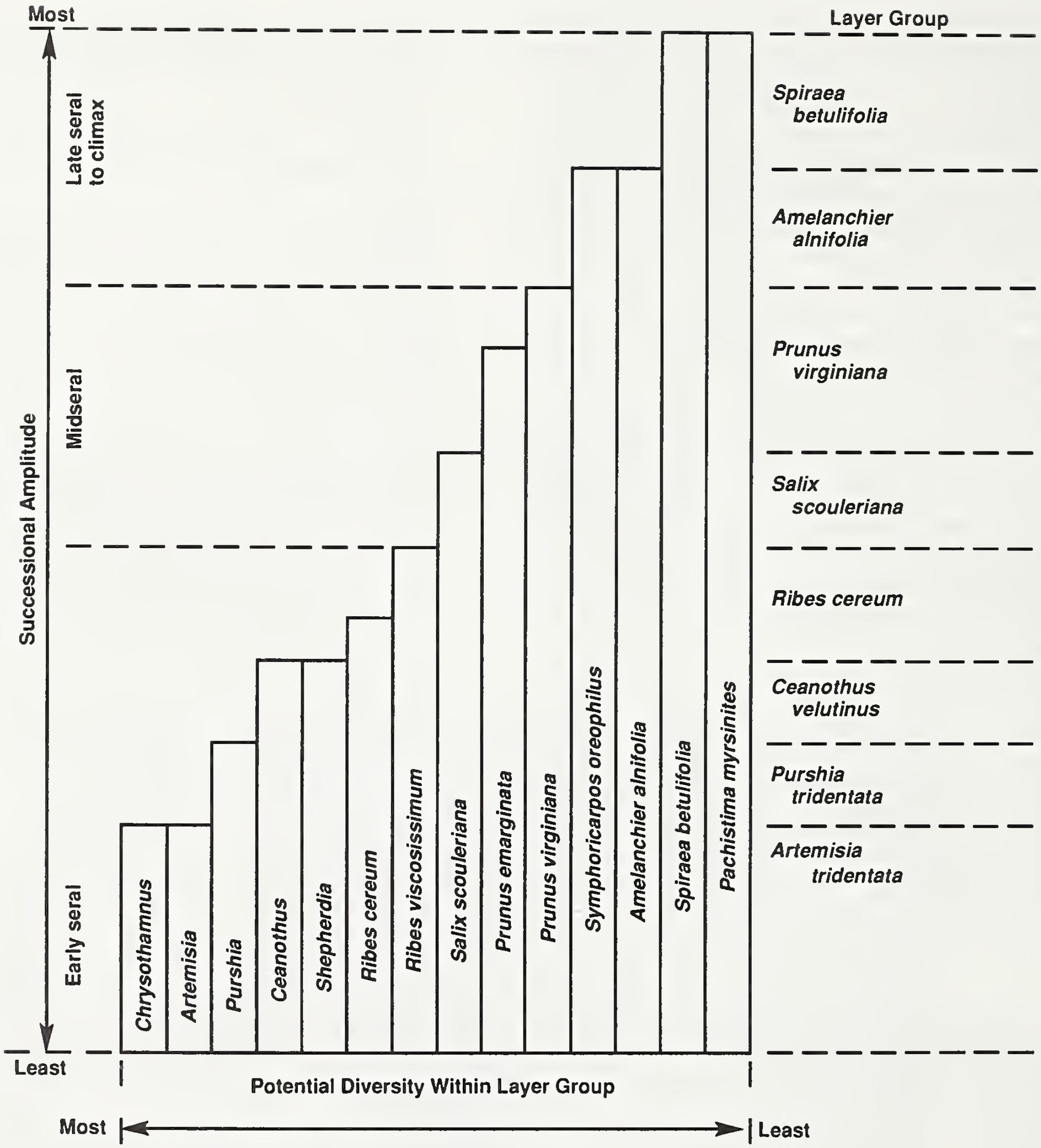

Figure 11—Relative successional amplitudes of major shrub species in the PSME/SPBE h.t.

amplitude and so have greater indicator value than species with more amplitude appearing later in the key. This same ranking of indicator value is used to select the dominant indicator for layer types when several species codominate the site. Alternate indicator species (fig. 11) appear with their appropriate primary indicator throughout the keys (tables 5, 6).

ARTEMISIA TRIDENTATA LAYER GROUP (ARTR L.G.)

Artemisia tridentata, mainly ssp. *vaseyana*, is an early seral colonizer of severely disturbed sites in the PSME/SPBE h.t. It can be important in the CARU phase, but is usually only a minor species in the PIPO and SPBE phases. Both *Artemisia* and the alternate indicator *Chrysothamnus* (mainly *C. nauseosus*) are wind-disseminated, nonrhizomatous shrubs with little tolerance for shade. Although these two genera may occupy different successional roles in nonforest habitats, in forests their differences are too slight to warrant distinction. In the PSME/SPBE h.t. both species will quickly invade soil exposed by scarification or burning. The initial shrub cover helps ameliorate the site and enhance establishment of forest species.

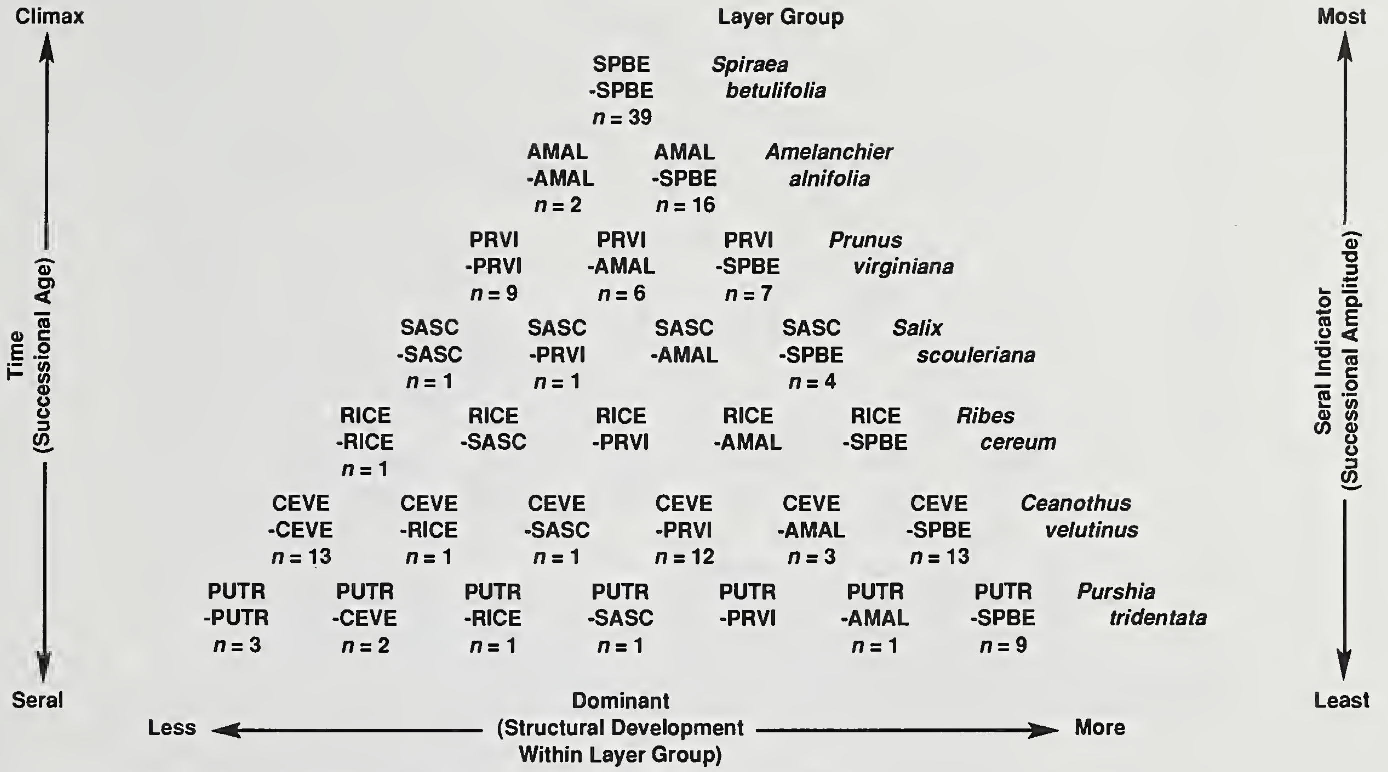

Figure 12—Succession classification diagram of the shrub layer in the PSME/ SPBE h.t., PIPO phase (n = number of samples in each layer type).

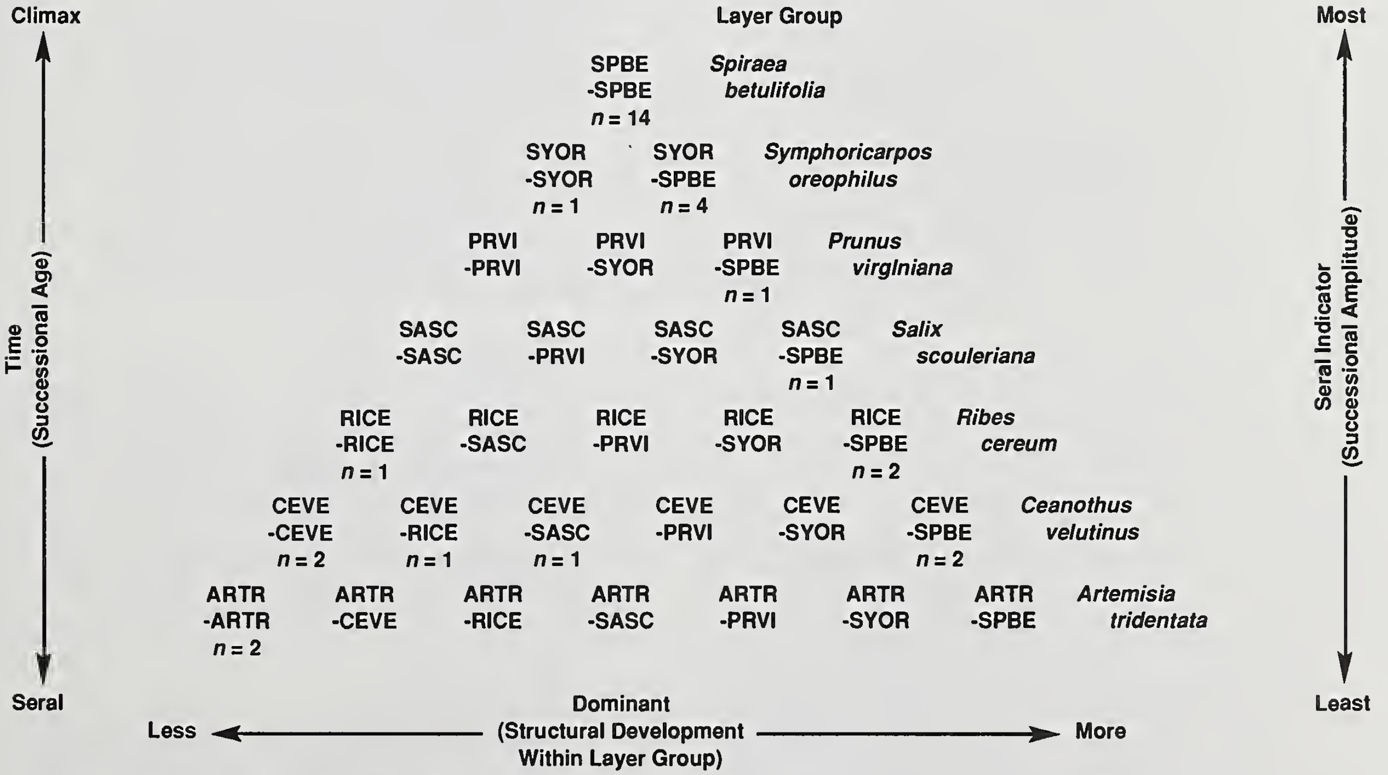

Figure 13—Succession classification diagram of the shrub layer in the PSME/ SPBE h.t., CARU phase (n = number of samples in each layer type).

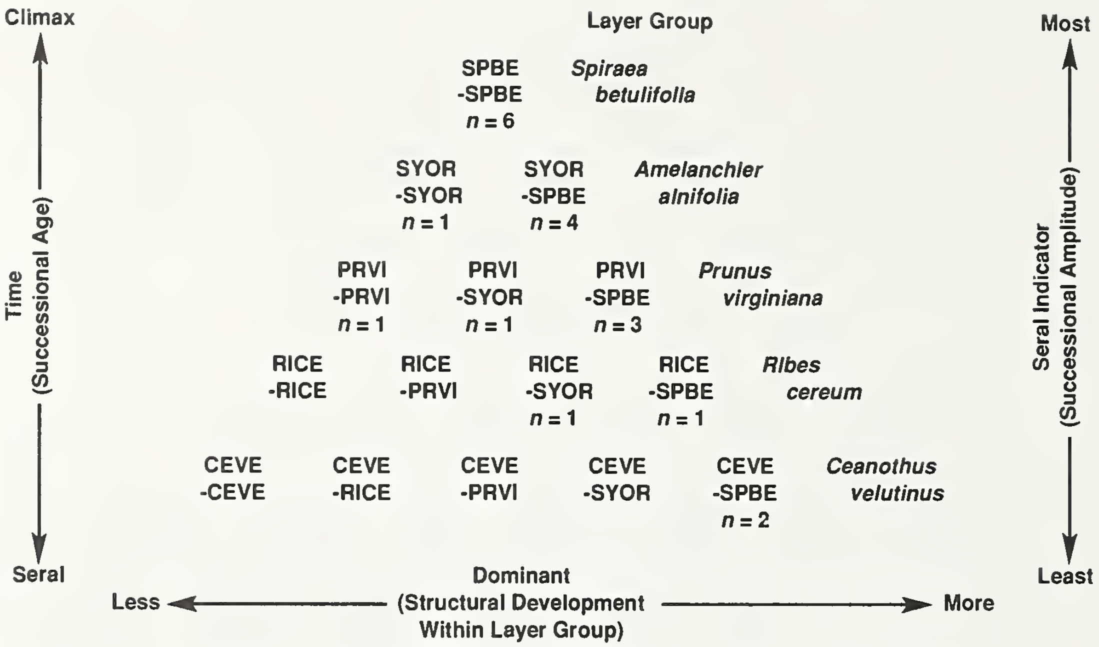

Figure 14—Succession classification diagram of the shrub layer in the PSME/SPBE h.t., SPBE phase (n = number of samples in each layer type).

Table 5—Key to shrub layer groups and layer types, with codes, in the PSME/SPBE h.t., PIPO phase

		Codes
1. *Purshia tridentata* (including *Artemisia*) well represented[1]	PUTR LAYER GROUP	125
1a. *Purshia* (including *Artemisia*) dominant	PUTR-PUTR Layer Type	125.125
1b. *Ceanothus* spp. dominant or codominant	PUTR-CEVE Layer Type	125.107
1c. *Ribes* spp. dominant or codominant	PUTR-RICE Layer Type	125.128
1d. *Salix* dominant or codominant	PUTR-SASC Layer Type	125.137
1e. *Prunus* spp. dominant or codominant	PUTR-PRVI Layer Type	125.124
1f. *Amelanchier* (including *Symphoricarpos oreophilus*) dominant or codominant	PUTR-AMAL Layer Type	125.105
1g. *Spiraea* spp. dominant or codominant	PUTR-SPBE Layer Type	125.142
1. *Purshia* (including *Artemisia*) poorly represented	2	
2. *Ceanothus velutinus* (including *C. sanguineus*) well represented	CEVE LAYER GROUP	107
2a. *Ceanothus* spp. dominant	CEVE-CEVE Layer Type	107.107
2b. *Ribes* spp. dominant or codominant	CEVE-RICE Layer Type	107.128
2c. *Salix* dominant or codominant	CEVE-SASC Layer Type	107.137
2d. *Prunus* spp. dominant or codominant	CEVE-PRVI Layer Type	107.124
2e. *Amelanchier* (including *Symphoricarpos oreophilus*) dominant or codominant	CEVE-AMAL Layer Type	107.105
2f. *Spiraea* spp. dominant or codominant	CEVE-SPBE Layer Type	107.142
2. *Ceanothus* spp. poorly represented	3	
3. *Ribes cereum* (including *R. viscosissimum*) well represented	RICE LAYER GROUP	128
3a. *Ribes* spp. dominant	RICE-RICE Layer Type	128.128
3b. *Salix* dominant or codominant	RICE-SASC Layer Type	128.137
3c. *Prunus* spp. dominant or codominant	RICE-PRVI Layer Type	128.124

(con.)

Table 5 (Con.)

		Codes
3d. *Amelanchier* (including *Symphoricarpos oreophilus*) dominant or codominant	RICE-AMAL Layer Type	128.105
3e. *Spiraea* spp. dominant or codominant	RICE-SPBE Layer Type	128.142
3. *Ribes* spp. poorly represented	4	
4. *Salix scouleriana* well represented	SASC LAYER GROUP	137
4a. *Salix* dominant	SASC-SASC Layer Type	137.137
4b. *Prunus* spp. dominant or codominant	SASC-PRVI Layer Type	137.124
4c. *Amelanchier* (including *Symphoricarpos oreophilus*) dominant or codominant	SASC-AMAL Layer Type	137.105
4d. *Spiraea* spp. dominant or codominant	SASC-SPBE Layer Type	137.142
4. *Salix* poorly represented	5	
5. *Prunus virginiana* (including *P. emarginata*) well represented	PRVI LAYER GROUP	124
5a. *Prunus* spp. dominant	PRVI-PRVI Layer Type	124.124
5b. *Amelanchier* (including *Symphoricarpos oreophilus*) dominant or codominant	PRVI-AMAL Layer Type	124.105
5c. *Spiraea* spp. dominant or codominant	PRVI-SPBE Layer Type	124.142
5. *Prunus* spp. poorly represented	6	
6. *Amelanchier alnifolia* (including *Symphoricarpos oreophilus*) well represented	AMAL LAYER GROUP	105
6a. *Amelanchier* (including *Symphoricarpos oreophilus*) dominant	AMAL-AMAL Layer Type	105.105
6b. *Spiraea* spp. dominant or codominant	AMAL-SPBE Layer Type	105.142
6. *Amelanchier alnifolia* (including *Symphoricarpos oreophilus*) poorly represented	7	
7. *Spiraea betulifolia* (including *S. pyramidata*) well represented	SPBE LAYER GROUP	142
7a. *Spiraea* spp. dominant	SPBE-SPBE Layer Type	142.142
7. *Spiraea* spp. poorly represented	Depauperate or unclassified layer type	

[1]"Well represented" means vertical canopy coverage ≥5 percent of the land area. First go through key to select the appropriate layer group, then key to the layer type. "Dominant" refers to greatest canopy coverage; "codominant" refers to nearly equal canopy coverage. When keying to layer type, choose the first condition that fits.

ARTR layer types are not widespread in PSME/SPBE but can easily occur in the CARU phase wherever *Artemisia* communities exist in the forest mosaic. They can result from scarification or intense burning. These layer types generally occur in full sunlight, declining rapidly as a tree canopy or taller shrub layer develops. They can progress to any of the other shrub layer types in the CARU phase.

PURSHIA TRIDENTATA LAYER GROUP (PUTR L.G.)

Purshia tridentata is a shade-intolerant, nonrhizomatous shrub. The seed is a smooth, dry achene with no obvious means of long-distance dispersal. Most seeds are disseminated by small rodents (Nord 1965) that carry them short distances and cache them in the soil. As a result, seedlings are usually found growing in clusters a short distance from the parent plant. Seedlings are seldom found next to parent plants even though many seeds fall in these areas. This phenomenon has been attributed to a toxin in the *Purshia* litter that inhibits seedling development (Nord 1965; Nord and Van Atta 1960). *Purshia* is a successful pioneer on many harsh sites having coarse-textured soils. It has some potential to fix nitrogen (Dalton and Zobel 1977) and will grow in frost-prone areas that exclude *Ceanothus*. It varies considerably in growth habit between populations. At upper elevations

Table 6—Key to shrub layer groups and layer types, with codes, in the PSME/SPBE h.t., CARU and SPBE phases

		Codes
1. *Artemisia tridentata* (including *Chrysothamnus*) well represented[1]	ARTR LAYER GROUP	150
1a. *Artemisia* (including *Chrysothamnus*) dominant	ARTR-ARTR Layer Type	150.150
1b. *Ceanothus* (including *Shepherdia*) dominant or codominant	ARTR-CEVE Layer Type	150.107
1c. *Ribes* spp. dominant or codominant	ARTR-RICE Layer Type	150.128
1d. *Salix* dominant or codominant	ARTR-SASC Layer Type	150.137
1e. *Prunus* spp. dominant or codominant	ARTR-PRVI Layer Type	150.124
1f. *Symphoricarpos oreophilus* (including *Amelanchier*) dominant or codominant	ARTR-SYOR Layer Type	150.163
1g. *Spiraea* spp. (including *Pachistima*) dominant or codominant	ARTR-SPBE Layer Type	150.142
1. *Artemisia tridentata* (including *Chrysothamnus*) poorly represented	2	
2. *Ceanothus velutinus* (including *Shepherdia canadensis*) well represented	CEVE LAYER GROUP	107
2a. *Ceanothus* (including *Shepherdia*) dominant	CEVE-CEVE Layer Type	107.107
2b. *Ribes* spp. dominant or codominant	CEVE-RICE Layer Type	107.128
2c. *Salix* dominant or codominant	CEVE-SASC Layer Type	107.137
2d. *Prunus* spp. dominant or codominant	CEVE-PRVI Layer Type	107.124
2e. *Symphoricarpos oreophilus* (including *Amelanchier*) dominant or codominant	CEVE-SYOR Layer Type	107.163
2f. *Spiraea* spp. (including *Pachistima*) dominant or codominant	CEVE-SPBE Layer Type	107.142
2. *Ceanothus* spp. poorly represented	3	
3. *Ribes cereum* (including *R. viscosissimum*) well represented	RICE LAYER GROUP	128
3a. *Ribes* spp. dominant	RICE-RICE Layer Type	128.128
3b. *Salix* dominant or codominant	RICE-SASC Layer Type	128.137
3c. *Prunus* spp. dominant or codominant	RICE-PRVI Layer Type	128.124
3d. *Symphoricarpos* (including *Amelanchier*) dominant or codominant	RICE-SYOR Layer Type	128.163
3e. *Spiraea* spp. (including *Pachistima*) dominant or codominant	RICE-SPBE Layer Type	128.142
3. *Ribes* spp. poorly represented	4	
4. *Salix scouleriana* well represented	SASC LAYER GROUP	137
4a. *Salix* dominant	SASC-SASC Layer Type	137.137
4b. *Prunus* spp. dominant or codominant	SASC-PRVI Layer Type	137.124
4c. *Symphoricarpos* (including *Amelanchier*) dominant or codominant	SASC-SYOR Layer Type	137.163
4d. *Spiraea* spp. (including *Pachistima*) dominant or codominant	SASC-SPBE Layer Type	137.142
4. *Salix* poorly represented	5	
5. *Prunus virginiana* (including *P. emarginata*) well represented	PRVI LAYER GROUP	124
5a. *Prunus* spp. dominant	PRVI-PRVI Layer Type	124.124
5b. *Symphoricarpos* (including *Amelanchier*) dominant or codominant	PRVI-SYOR Layer Type	124.163

(con.)

Table 6 (Con.)

		Codes
5c. *Spiraea* spp. (including *Pachistima*) dominant or codominant	PRVI-SPBE Layer Type	124.142
5. *Prunus* spp. poorly represented	6	
6. *Symphoricarpos oreophilus* (including *Amelanchier*) well represented	SYOR LAYER GROUP	163
6a. *Symphoricarpos* (including *Amelanchier*) dominant	SYOR-SYOR Layer Type	163.163
6b. *Spiraea* spp. (including *Pachistima*) dominant or codominant	SYOR-SPBE Layer Type	163.142
6. *Symphoricarpos* (including *Amelanchier*) poorly represented	7	
7. *Spiraea betulifolia* (including *S. pyramidata* and *Pachistima myrsinites*) well represented	SPBE LAYER GROUP	142
7a. *Spiraea* spp. (including *Pachistima*) dominant	SPBE-SPBE Layer Type	142.142
7. *Spiraea* spp. (including *Pachistima*) poorly represented	Depauperate or unclassified layer type	

[1]"Well represented" means vertical canopy coverage ≥5 percent of the land area. First go through key to select the appropriate layer group, then key to the layer type. "Dominant" refers to greatest canopy coverage; "codominant" refers to nearly equal. When keying to layer type, choose the first condition that fits.

some populations are more prostrate and tend to increase by layering (Nord 1965). In eastern Idaho some *Purshia* stands resprout following burning (Blaisdell and Mueggler 1956). In central Idaho forests some *Purshia* stands resprout following low-intensity burns such as spring burns but are killed by the high-intensity burns that are more common in the fall.

Artemisia tridentata is an alternate indicator of the PUTR layer group in the PSME/SPBE h.t., PIPO phase. However, *Artemisia* is a primary indicator in the CARU phase where it is more abundant (see ARTR l.g.).

Of the seven potential PUTR layer types in the PSME/SPBE h.t., six were found (fig. 12). The PUTR layer types generally result from scarification and often appear in frost-prone areas. Initial establishment may be slow until a *Purshia* seed source occurs on the site. *Artemisia*, however, can establish more rapidly from wind-borne seed. Both shrubs reach a maximum height of 2 to 3 feet (0.6 to 0.9 meters) in the PSME/SPBE h.t.

CEANOTHUS VELUTINUS LAYER GROUP (CEVE L.G.)

Ceanothus velutinus is a shade-intolerant, nonrhizomatous shrub that is valuable for big-game browse, songbird habitat (Thomas 1979), and nitrogen fixation (Youngberg and Wollum 1976). Its small, dry seeds have no apparent means of long-distance dispersal, but some are likely eaten and transported by birds. Chipmunks are often seen feeding on the fruits and may provide short-distance dispersal. Most seed, however, falls to the ground where it can remain viable in the soil and duff for at least 200 to 300 years (Gratkowski 1962) and possibly over 500 years (Zavitkovski and Newton 1968). The seed germinates readily following burning, often in direct proportion to burning intensity. As a result, severely burned areas can produce dense thickets that discourage access by humans and livestock. In the PSME/SPBE h.t., *Ceanothus* can grow 3 to 5 feet (0.9 to 1.5 meters) tall; on more productive sites, such as those found in the grand fir/mountain maple h.t., it can reach 7 feet (2.1 meters) (Steele and Geier-Hayes 1992). *Ceanothus* encounters its environmental limits in the PSME/SPBE h.t. As elevations increase, *Ceanothus* becomes stunted, possibly from repeated frost damage or inadequate snow cover during winter. *Ceanothus* reaches its cold limits in the CARU phase and is rare in the SPBE phase.

Shepherdia canadensis is a shade-intolerant, nonrhizomatous shrub that fixes nitrogen and is a valuable big-game browse. Its seed has a fleshy coating and may be dispersed by birds and mammals. The

seed appears to remain viable in the soil and germinate following burning. *Shepherdia* develops best on sites that are too cold for *Ceanothus*. It appears to be a successional equivalent of *Ceanothus* in the cooler SPBE and CARU phases.

Of the six possible CEVE layer types in the PSME/SPBE h.t., all were found in the PIPO phase (fig. 12), but fewer layer types were found in either the CARU or SPBE phases (figs. 13, 14). The CEVE-CEVE layer type is quite common in the PIPO phase and develops after broadcast burning or from thorough scarification. Canopy cover is generally greater following burning. Most of the other CEVE layer types were on sites where the most recent disturbance had been scarification. The CEVE-RICE layer type generally results directly from scarification treatments. The remaining layer types may have survived the treatment or evolved successionally from CEVE-CEVE or CEVE-RICE layer types.

CEVE layer types represent an early seral condition. Normally they persist until shaded by a tree or tall shrub canopy. In the PSME/SPBE h.t., however, tree canopies are often patchy, allowing CEVE layer types to persist for 40 years or more after trees become established.

RIBES CEREUM LAYER GROUP (RICE L.G.)

The RICE layer group is denoted by *Ribes cereum*, but other species of *Ribes* can occur. Occasionally *R. viscosissimum* may be present, as well as small amounts of other *Ribes* species. These *Ribes* are characteristically early seral nonrhizomatous shrubs, often the first to dominate well-scarified sites. Because they have a low tolerance for shade, they begin declining shortly after a canopy taller than their own develops. The *Ribes*, however, seem to maintain their coverages longer than *Ceanothus* and so are considered slightly less vulnerable to succession. Like *Ceanothus*, numerous *Ribes* seeds remain viable in the soil and duff long after the parent shrubs have disappeared. But since *Ribes* have a fleshy fruit, many seeds are also dispersed by birds and mammals. *Ribes cereum* has some allelopathic capability (Heisey and Delwiche 1983), but its effectiveness in the PSME/SPBE h.t. has not been studied.

There are five potential RICE layer types in the PIPO and CARU phases (figs. 12, 13) and four in the SPBE phase (fig. 14). Under present conditions they are not common in any of the three phases. RICE layer types generally result from scarification but can result from burning on sites that are too cool or too frost prone for *Ceanothus*. Usually the scarification is either general logging disturbance or prescribed mechanical treatments, but some sites are scarified by livestock.

RICE layer types can develop quickly following disturbance but seldom create dense canopies. Planted pines may be overtopped by young *Ribes* for several years following planting, but the sparse *Ribes* canopy seldom outcompetes the pine. As *Ribes* plants get older, their canopies thicken somewhat and provide favorable microsites for *Pseudotsuga* seedlings.

SALIX SCOULERIANA LAYER GROUP (SASC L.G.)

Salix scouleriana is a nonrhizomatous shrub that is valuable big-game browse (appendix A). It can also provide nesting and feeding habitat for small birds. Its light wind-borne seeds are dispersed widely in late spring. Because the seeds' viability is short lived, it requires moist mineral soil for germination (Brinkman 1974). *Salix* is only slightly tolerant of shade, but its tall growth habit enables it to persist in small openings on well-timbered sites. In these situations, *Salix* has an upright growth form and relatively sparse canopy. In clearcuts or burned-over areas, *Salix* rapidly resprouts, providing succulent forage for deer and elk. In these areas of full sunlight, *Salix* develops a broad, rounded growth form with a relatively dense canopy that can outcompete shade-intolerant species. The newly formed canopy helps protect the site from sun and wind. The shade may enhance *Pseudotsuga* establishment but can jeopardize survival of *Pinus ponderosa* seedlings, which are less shade tolerant.

The SASC layer types are not widespread in the PSME/SPBE h.t., occurring only on sites in moister portions of the PIPO and CARU phases. They were not found in the SPBE phase. They may occur following intense burning or machine scarification. Contour ditches that retain excess moisture in exposed soil are especially apt to produce SASC layer types. All sample stands in this layer group had received heavy machine scarification either from bulldozer-pile and burn or contour terrace operations about 18 years before sampling, or they had experienced a severe wildfire at least 40 years ago.

PRUNUS VIRGINIANA LAYER GROUP (PRVI L.G.)

Prunus virginiana and the alternate indicator, *P. emarginata*, are somewhat shade-tolerant shrubs. They generate many root sprouts, tending to form thickets that provide important food and cover for wildlife. Birds and mammals disperse the heavy flesh-covered seed in the fall. These seeds can remain viable in the soil and duff for many years (Kramer 1984). The seed has an embryo dormancy (Grisez 1974) that is offset by winter conditions. It germinates in early spring and probably responds

best to broadcast burning. *Prunus emarginata* is less widespread in the PSME/SPBE h.t. than is *P. virginiana* and appears to be slightly less shade tolerant.

PRVI layer types occur in all phases of PSME/SPBE but are most common in the warm PIPO phase (figs. 12, 13, 14). Most of the sites where PRVI layer types were found had been severely burned in the past; some had been logged and scarified more recently. However, there is little indication that PRVI layer types result directly from any particular disturbance. Apparently they evolved successionally from CEVE, RICE, and SASC layer types and survived recent burning and scarification treatments. Unless herbicides can be used, removing these layer types would require deep and thorough scarification that could jeopardize soil and water resources. Burning will likely stimulate these layer types and may cause them to revert to the CEVE layer group.

AMELANCHIER ALNIFOLIA LAYER GROUP (AMAL L.G.)

Amelanchier alnifolia is a common, nonrhizomatous shrub in many shrub layer types. It has moderate to high forage value for deer and elk; the fleshy fruits are also sought by many other mammals and birds that disperse the seed. Young seedlings are often found in clusters as if from seed cached by a small rodent or from a bird dropping. *Amelanchier* is moderately shade tolerant and is often well represented on timbered sites as well as on open shrubfields. It grows rapidly in full sun, but beneath a tree canopy its canopy cover declines more slowly than most other seral shrubs, making it an indicator of late seral conditions.

Symphoricarpos oreophilus is an alternate indicator of the AMAL layer groups in the PSME/SPBE h.t., PIPO phase. It occurs here less frequently than *Amelanchier* but occurs much more frequently than *Amelanchier* in the CARU and SPBE phases, and so is used as the primary indicator in those two phases (see SYOR l.g.).

The AMAL l.g. consists of two layer types, both of which were sampled (appendix A). The AMAL-AMAL layer type resulted from clearcuts having little or no site preparation about 17 years earlier. The AMAL-SPBE layer type resulted from successional advance of timbered sites that were either completely burned or underburned 50 to 75 years earlier and from successional advance of well-stocked plantations that are over 20 years old. This layer type also occurred in more recent clearcuts or partial cuts that received no site preparation or just light scarification. In these cases, the AMAL-SPBE layer type simply survived the disturbance. It appears that the AMAL l.g. is derived mainly from successional advance but can be maintained by clearcutting without additional treatment. Methods for attaining these layer types through direct site treatment remain unknown.

SYMPHORICARPOS OREOPHILUS LAYER GROUP (SYOR L.G.)

Symphoricarpos oreophilus is a nonrhizomatous, moderately shade-tolerant shrub that is widespread in central Idaho. It produces a fruit which, though not eagerly sought, is likely dispersed by birds and mammals. *Symphoricarpos* seedlings are usually found growing in a dense cluster as if grown from a cache made by a small rodent or from a bird dropping. This shrub has low to moderate forage value for large herbivores and is often well represented on timbered sites as well as deforested areas.

Amelanchier alnifolia is an alternate indicator of the SYOR layer group in the CARU and SPBE phases of the PSME/SPBE h.t. In these two phases it occurs less frequently than *Symphoricarpos* and is often excluded by the cooler, drier conditions on sites where these phases are found. In the warmer PIPO phase it occurs more frequently than *Symphoricarpos* and serves as the primary indicator (see AMAL l.g.).

SYOR layer types and especially SYOR-SPBE are common in the CARU and SPBE phases. They represent a late seral to near-climax condition; therefore, they are not usually created directly by disturbance. In most cases SYOR layer types have evolved successionally following wildfires that occurred about 80 years ago. A few have survived recent logging and low-intensity broadcast burning.

SPIRAEA BETULIFOLIA LAYER GROUP (SPBE L.G.)

Spiraea betulifolia and *S. pyramidata* are moderately shade-tolerant, rhizomatous shrubs with roots that grow deep into the mineral soil. Mechanical scarification and stripping seldom completely remove the *Spiraea* root system, which will resprout within the next growing season. *Spiraea* has moderate forage value for deer and elk (appendix A).

Pachistima myrsinites is a shade-tolerant, rhizomatous shrub. It is common on PSME/SPBE h.t. sites in eastern Idaho and serves as an alternate indicator of *Spiraea* in that area. *Pachistima* has moderate forage value for deer and elk (appendix A).

The SPBE layer group consists of one layer type, SPBE-SPBE, and represents a climax shrub layer in the PSME/SPBE h.t. This layer type generally does not result from site disturbance but evolves successionally over many decades. In most sampled stands SPBE-SPBE occurred beneath a well-developed and

often dense tree canopy. In some cases, it occurred on cutover sites that received either no site preparation, or scarification with little response. In those cases, it did not result from the disturbance but survived it.

The Herb Layer

Herb layer succession is generally more complex than succession in the tree or shrub layer, because herbaceous species are more numerous. Since herb layer succession is truncated by the tree and shrub layers in many cases, some potential herb layer types are rarely found. One might assume that herb layer succession in the PSME/SPBE h.t., which is relatively dry, would be less complex than in moister habitats; this does not appear to be the case. Species from even drier habitats become seral components in the PSME/SPBE h.t., maintaining a diversity nearly comparable to that of moister forest habitats.

Table 7 lists the herb layer species with greater than 5 percent cover in at least one location. Many unlisted species may be present in lesser amounts, and some potentially important species may yet be found. Relative successional amplitudes of important herb layer species (fig. 15) were derived by developing hypotheses for each species followed by testing through many field observations and data analysis. Because succession in the herb layer progresses rapidly, successional amplitudes for some herb layer species can also be derived from the permanent plot records of Stickney (1980, 1985). As in the tree and shrub layers, successional amplitudes of herb layer species are meaningful only in a relative sense, and the greatest accuracy lies with those amplitudes that are farthest apart. For instance, species indicating the Annuals layer group

Table 7—Successional roles of important herb layer species in phases of the PSME/SPBE h.t.

Code No.	Herb layer species	Abbreviation	Phase PIPO	Phase CARU	Phase SPBE
Perennial graminoids					
[1]*18	*Agropyron intermedium*	AGIN	(ES)[2]	—	—
301	*Agropyron spicatum*	AGSP	(ES)	(es)	ES
303	*Bromus carinatus*	BRCA	ES	ES	ES
282	*Bromus inermis*	BRIN	MS	ms	ms
307	*Calamagrostis rubescens*	CARU	C	C	—
309	*Carex geyeri*	CAGE	LS	LS	C
311	*Carex rossii*	CARO	ES	ES	ES
331	*Poa nervosa*	PONE	LS	LS	C
Perennial herbs					
415	*Apocynum androsaemifolium*	APAN	MS	(ms)	(ms)
421	*Arnica cordifolia*	ARCO	C	C	C
426	*Aster conspicuus*	ASCO	LS	(ls)	(LS)
586	*Aster perelegans*	ASPE	MS	ms	ms
430	*Astragalus miser*	ASMI	—	(C)	(C)
431	*Balsamorhiza sagittata*	BASA	MS	(ms)	MS
438	*Castilleja miniata*	CAMI	MS	MS	MS
459	*Epilobium angustifolium*	EPAN	MS	MS	—
465	*Fragaria vesca*	FRVE	MS	MS	(ms)
466	*Fragaria virginiana*	FRVI	MS	MS	(ms)
473	*Geranium viscosissimum*	GEVI	MS	MS	MS
833	*Iliamna rivularis*	ILRI	ES	es	ES
728	*Lupinus caudatus*	LUCA	(LS)	LS	—
643	*Lupinus sericeus*	LUSE	(LS)	LS	—
658	*Penstemon attenuatus*	PEAT	MS	—	—
522	*Potentilla glandulosa*	POGL	ES	ES	ES
547	*Thalictrum occidentale*	THOC	(C)	(C)	(C)
691	*Veratrum californicum*	VECA	MS	—	—

[1]* = Nonnative species.
[2]C = major climax; ES = early seral; LS = late seral; MS = midseral; Lower case letters = minor occurrence; upper case letters = major occurrence; ( ) = occurs in only part of phase.

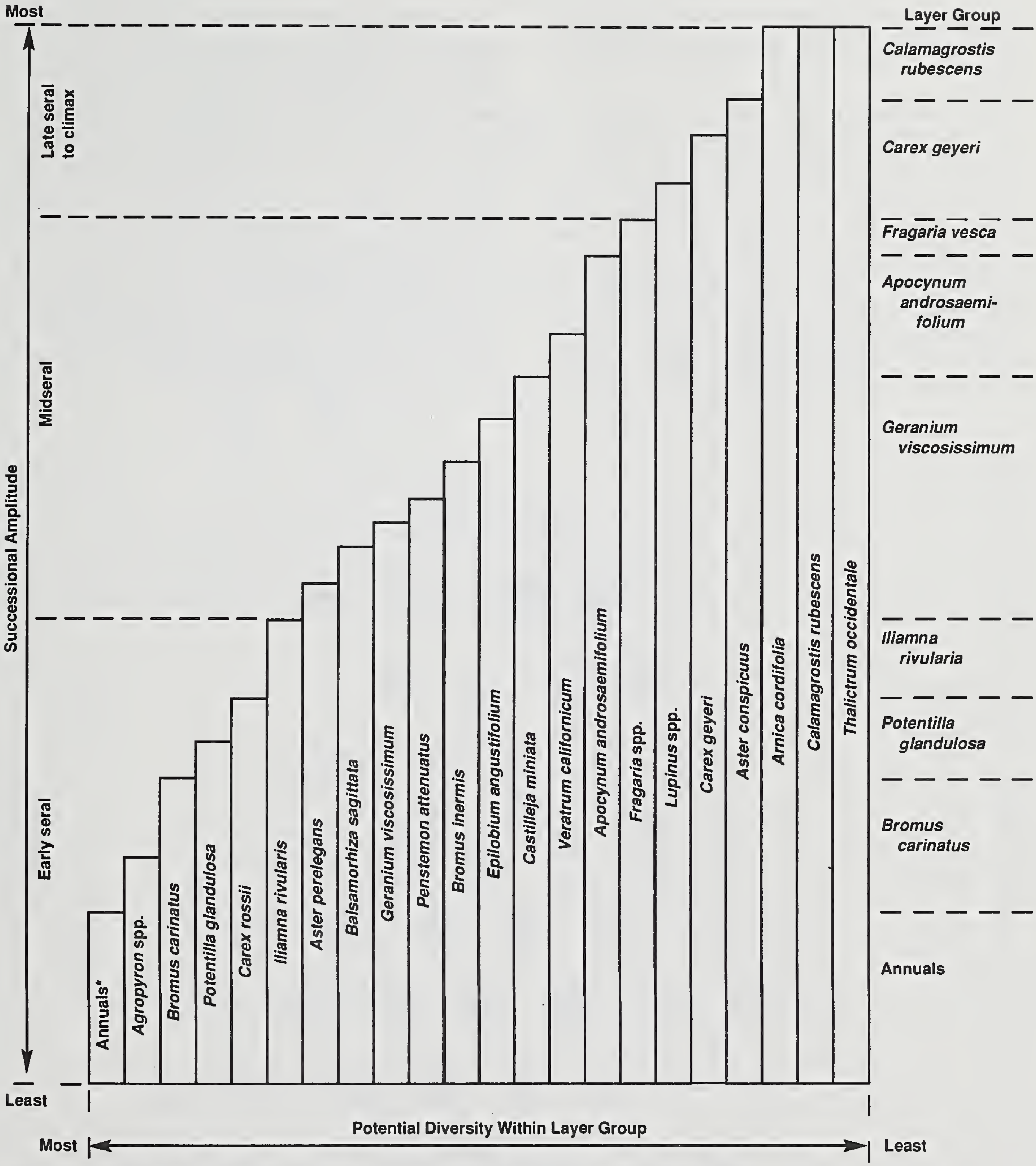

Figure 15—Relative successional amplitudes of major herb layer species in the PSME/SPBE h.t.
*Includes annuals, biennials, and short-lived perennials.

clearly have less amplitude than *Calamagrostis* (fig. 15). But the relative amplitudes of adjacent taxa such as *Fragaria* and *Apocynum* are less certain.

The relative successional amplitudes in figure 15 provide a basis for the herb layer classifications (figs. 16, 17, 18). The entire classification consists of nine layer groups; the full data set appears in appendix B. Although the herb layer classification is based on 139 sample plots in the PIPO phase, 30 in the CARU phase, and 17 in the SPBE phase, some layer groups have little data. Data in the Annuals layer group are scarce. These conditions often occur within 5 years following disturbance; recently disturbed sites were not a sampling objective. Other layer types may be found with more reconnaissance, may appear only after uncommon disturbances, or may be rare under any circumstances.

The key to herb layer types (table 8), derived from the classification diagrams (figs. 16, 17, 18), contains many alternate indicator species. Lumping species helps maintain a workable number of layer types in this diverse vegetative layer. In some cases, combining indicator species has reduced uniformity within the layer type, because the combined species represent minor differences of environment or disturbance response within the habitat type. In other cases, the alternate indicators are common environmental and disturbance response equivalents, and the layer type remains substantially uniform. In all cases, the lumped species appear to have similar successional amplitudes (fig. 15).

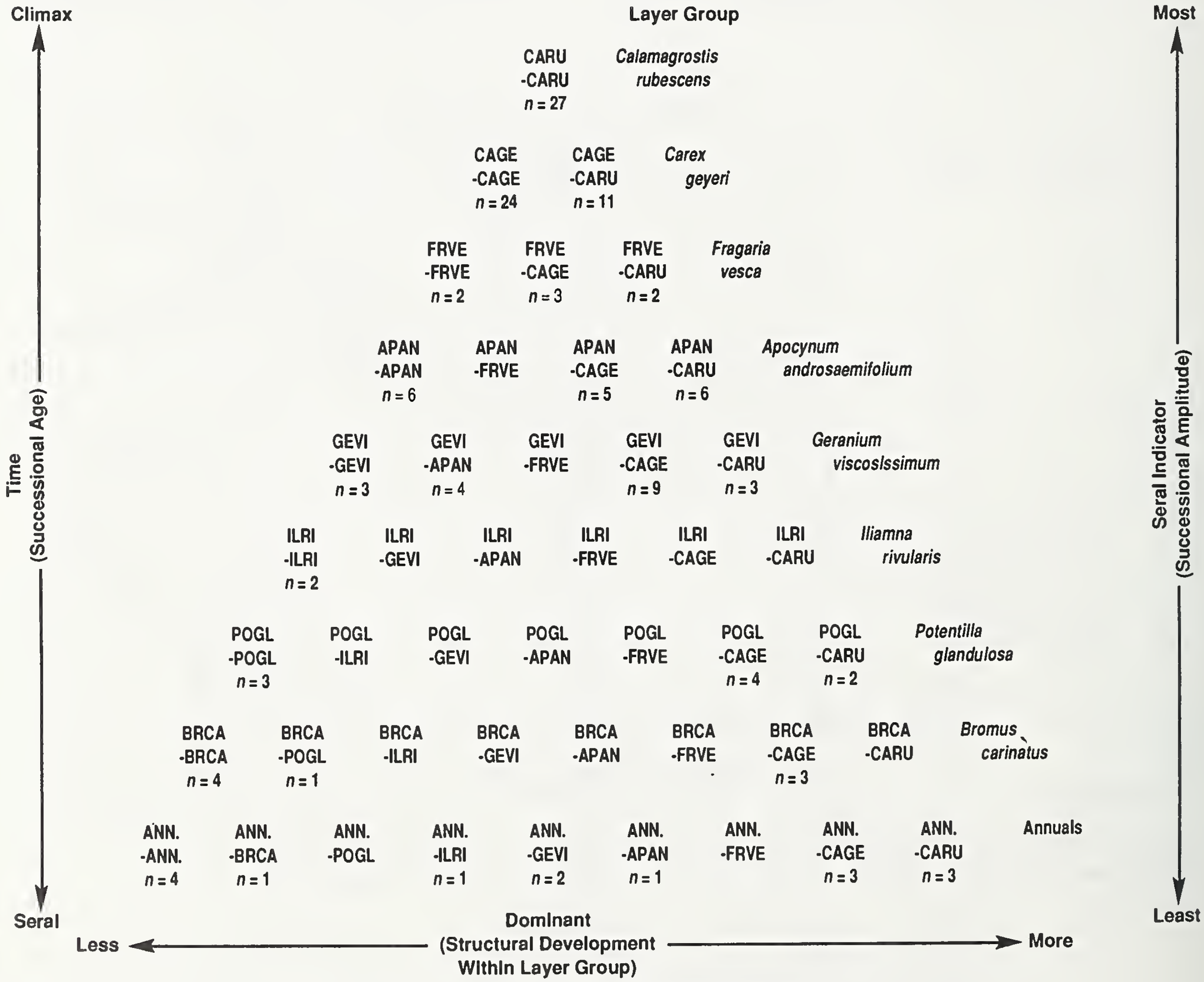

Figure 16—Succession classification diagram of the herb layer in the PSME/SPBE h.t., PIPO phase (*n* = number of samples in each layer type).

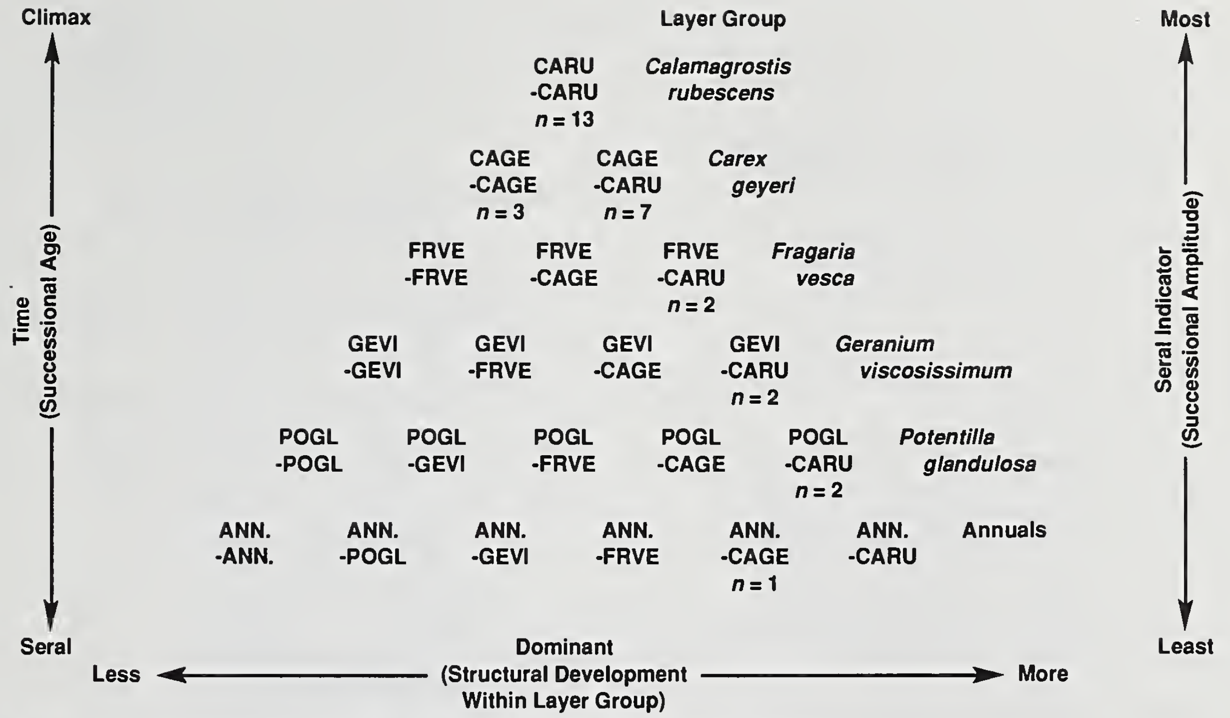

Figure 17—Succession classification diagram of the herb layer in the PSME/SPBE h.t., CARU phase (*n* = number of samples in each layer type).

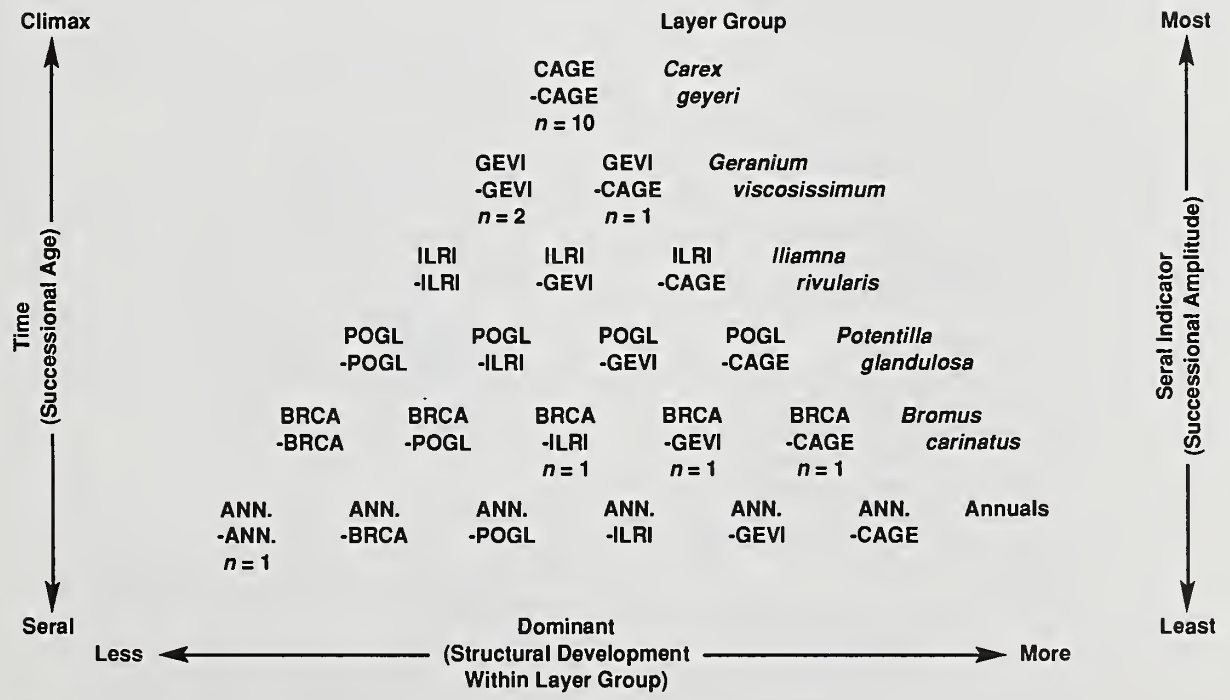

Figure 18—Succession classification diagram of the herb layer in the PSME/SPBE h.t., SPBE phase (*n* = number of samples in each layer type).

Table 8—Key to herb layer groups and layer types, with codes, in the PSME/SPBE h.t.

		Codes
1. Annuals, biennials, and short-lived perennials (see layer group description for species) well represented[1] either individually or collectively	ANNUALS LAYER GROUP	900
1a. The above species dominant	ANN.-ANN. Layer Type	900.900
1b. *Bromus carinatus* (including *Agropyron* spp.) dominant or codominant	ANN.-BRCA Layer Type	900.303
1c. *Potentilla glandulosa* (including *Carex rossii*) dominant or codominant	ANN.-POGL Layer Type	900.522
1d. *Iliamna rivularis* dominant or codominant	ANN.-ILRI Layer Type	900.833
1e. *Geranium viscosissimum* (including *Aster perelegans, Balsamorhiza, Penstemon attenuatus, Epilobium, Bromus inermis,* and *Castilleja*) dominant or codominant	ANN.-GEVI Layer Type	900.473
1f. *Apocynum androsaemifolium* (including *Veratrum*) dominant or codominant	ANN.-APAN Layer Type	900.415
1g. *Fragaria vesca* (including *F. virginiana*) dominant or codominant	ANN.-FRVE Layer Type	900.465
1h. *Carex geyeri* (including *Aster conspicuus* and *Lupinus* spp.) dominant or codominant	ANN.-CAGE Layer Type	900.309
1i. *Calamagrostis rubescens* (including *Arnica* and *Thalictrum*) dominant or codominant	ANN.-CARU Layer Type	900.307
1. Annuals, biennials, and short-lived perennials poorly represented	2	
2. *Bromus carinatus* (including *Agropyron* spp.) well represented	BRCA LAYER GROUP	303
2a. The above species dominant	BRCA-BRCA Layer Type	303.303
2b. *Potentilla glandulosa* (including *Carex rossii*) dominant or codominant	BRCA-POGL Layer Type	303.522
2c. *Iliamna rivularis* dominant or codominant	BRCA-ILRI Layer Type	303.833
2d. *Geranium viscosissimum* (including *Aster perelgans, Balsamorhiza, Penstemon attenuatus, Epilobium, Bromus inermis,* and *Castilleja*) dominant or codominant.	BRCA-GEVI Layer Type	303.473
2e. *Apocynum androsaemifolium* (including *Veratrum*) dominant or codominant.	BRCA-APAN Layer Type	303.415
2f. *Fragaria vesca* (including *F. virginiana*) dominant or codominant	BRCA-FRVE Layer Type	303.465
2g. *Carex geyeri* (including *Aster conspicuus* and *Lupinus* spp.) dominant or codominant.	BRCA-CAGE Layer Type	303.309
2h. *Calamagrostis rubescens* (including *Arnica* and *Thalictrum*) dominant or codominant	BRCA-CARU Layer Type	303.307
2. *Bromus carinatus* (including *Agropyron* spp.) poorly represented.	3	

(con.)

Table 8 (Con.)

		Codes
3. *Potentilla glandulosa* (including *Carex rossii*) well represented	POGL LAYER GROUP	522
3a. The above species dominant	POGL-POGL Layer Type	522.522
3b. *Iliamna rivularis* dominant or codominant	POGL-ILRI Layer Type	522.833
3c. *Geranium viscosissimum* (including *Aster perelegans, Balsamorhiza, Penstemon attenuatus, Epilobium, Bromus inermis,* and *Castilleja*) dominant or codominant	POGL-GEVI Layer Type	522.473
3d. *Apocynum androsaemifolium* (including *Veratrum*) dominant or codominant	POGL-APAN Layer Type	522.415
3e. *Fragaria vesca* (including *F. virginiana*) dominant or codominant	POGL-FRVE Layer Type	522.465
3f. *Carex geyeri* (including *Aster conspicuus* and *Lupinus* spp.) dominant or codominant	POGL-CAGE Layer Type	522.309
3g. *Calamagrostis rubescens* (including *Arnica* and *Thalictrum*) dominant or codominant	POGL-CARU Layer Type	522.307
3. *Potentilla* (including *Carex rossii*) poorly represented	4	
4. *Iliamna rivularis* well represented	ILRI LAYER GROUP	833
4a. *Iliamna rivularis* dominant	ILRI-ILRI Layer Type	833.833
4b. *Geranium viscosissimum* (including *Aster perelegans, Balsamorhiza, Penstemon attenuatus, Epilobium, Bromus inermis,* and *Castilleja*) dominant or codominant	ILRI-GEVI Layer Type	833.473
4c. *Apocynum androsaemifolium* (including *Veratrum*) dominant or codominant.	ILRI-APAN Layer Type	833.415
4d. *Fragaria vesca* (including *F. virginiana*) dominant or codominant.	ILRI-FRVE Layer Type	833.465
4e. *Carex geyeri* (including *Aster conspicuus* and *Lupinus* spp.) dominant or codominant.	ILRI-CAGE Layer Type	833.309
4f. *Calamagrostis rubescens* (including *Arnica* and *Thalictrum*) dominant or codominant	ILRI-CARU Layer Type	833.307
4. *Iliamna* poorly represented.	5	
5. *Geranium viscosissimum* (including *Aster perelegans, Balsamorhiza, Penstemon attenuatus, Eplilobium, Bromus inermis,* and *Castilleja*) well represented	GEVI LAYER GROUP	473
5a. The above species dominant	GEVI-GEVI Layer Type	473.473
5b. *Apocynum androsaemifolium* (including *Veratrum*) dominant or codominant	GEVI-APAN Layer Type	473.415
5c. *Fragaria vesca* (including *F. virginiana*) dominant or codominant	GEVI-FRVE Layer Type	473.465

(con.)

Table 8 (Con.)

		Codes
5d. *Carex geyeri* (including *Aster conspicuus* and *Lupinus* spp.) dominant or codominant	GEVI-CAGE Layer Type	473.309
5e. *Calamagrostis rubescens* (including *Arnica* and *Thalictrum*) dominant or codominant	GEVI-CARU Layer Type	473.307
5. *Geranium* (including *Aster perelegans*, *Balsamorhiza*, *Penstemon*, *Epilobium*, *Bromus inermis*, and *Castilleja*) poorly represented	6	
6. *Apocynum androsaemifolium* (including *Veratrum*) well represented	APAN LAYER GROUP	415
6a. The above species dominant	APAN-APAN Layer Type	415.415
6b. *Fragaria vesca* (including *F. virginiana*) dominant or codominant	APAN-FRVE Layer Type	415.465
6c. *Carex geyeri* (including *Aster conspicuus* and *Lupinus* spp.) dominant or codominant	APAN-CAGE Layer Type	415.309
6d. *Calamagrostis rubescens* (including *Arnica* and *Thalictrum*) dominant or codominant	APAN-CARU Layer Type	415.307
6. *Apocynum* (including *Veratrum*) poorly represented	7	
7. *Fragaria vesca* (including *F. virginiana*) well represented	FRVE LAYER GROUP	465
7a. *Fragaria* spp. dominant	FRVE-FRVE Layer Type	465.465
7b. *Carex geyeri* (including *Aster conspicuus* and *Lupinus* spp.) dominant or codominant	FRVE-CAGE Layer Type	465.309
7c. *Calamagrostis rubescens* (including *Arnica* and *Thalictrum*) dominant or codominant	FRVE-CARU Layer Type	465.307
7. *Fragaria* spp. poorly represented	8	
8. *Carex geyeri* (including *Aster conspicuus* and *Lupinus* spp.) well represented.	CAGE LAYER GROUP	309
8a. The above species dominant	CAGE-CAGE Layer Type	309.309
8b. *Calamagrostis rubescens* (including *Arnica* and *Thalictrum*) dominant or codominant	CAGE-CARU Layer Type	309.307
8. *Carex* (including *Aster* and *Lupinus*) poorly represented	9	
9. *Calamagrostis rubescens* (including *Arnica* and *Thalictrum*) well represented	CARU LAYER GROUP	307
9a. The above species dominant	CARU-CARU Layer Type	307.307
9. *Calamagrostis* (including *Arnica* and *Thalictrum*) poorly represented	Depauperate or unclassified layer type	

[1]"Well represented" means vertical canopy coverage ≥5 percent of the land area. First go through key to select the appropriate layer group, then key to the layer type. "Dominant" refers to greatest canopy coverage; "codominant" refers to nearly equal canopy coverage. When keying to layer type, choose the first condition that fits.

Early seral annuals, biennials, and short-lived perennials were grouped into one unit, because there appears to be no practical reason to recognize them individually. *Agropyron spicatum* and *A. intermedium* were grouped with *Bromus carinatus* as early seral species that develop mainly under little or no grazing pressure. *Carex rossii* was grouped with *Potentilla*, because both species store their seed in the soil and respond to scarification. *Aster perelegans, Balsamorhiza, Castilleja, Epilobium angustifolium, Bromus inermis,* and *Penstemon attenuatus* are occasionally well represented in PSME/SPBE and were grouped with *Geranium* as midseral indicators. *Veratrum* was grouped with *Apocynum* as a midseral, rhizomatous species with some tolerance for shade. *Aster conspicuus* was grouped with *Carex geyeri* as a near-climax indicator. *Arnica* and *Thalictrum* were grouped with *Calamagrostis* as climax species, all of which are rhizomatous.

ANNUALS LAYER GROUP (ANN. L.G.)

Annuals, mainly species of *Bromus, Epilobium, Galium,* and *Gayophytum,* and occasionally *Nemophila, Collomia,* and *Cryptantha,* can develop high coverages on newly exposed soil in full sunlight. These taxa have little competitive ability; their annual nature makes them vulnerable to replacement by any perennial. Likewise, biennials such as *Verbascum thapsus* and *Cirsium vulgare* and the short-lived perennials, *Phacelia hastata* and *Gnaphalium microcephalum,* must reestablish frequently in order to maintain high coverages. Without recurring disturbance these taxa are also quickly replaced during successional advance. The relative amounts of these invaders vary considerably following disturbance and appear to be mainly a function of available seed. The Annuals layer group represents the earliest seral conditions of the herb layer. It is often replaced within the first 5 years following disturbance but can be maintained by livestock use.

***BROMUS CARINATUS* LAYER GROUP (BRCA L.G.)**

Bromus carinatus is a nonrhizomatous grass that has little tolerance for shade and decreases under grazing, mainly from cattle. Occasionally it develops high coverages in early seral stages either from direct seeding or natural colonization. In either case, however, the sites receive little or no grazing.

Agropyron spicatum and *A. intermedium* are similar to *Bromus carinatus* in terms of successional strategy. They are nonrhizomatous grasses that have little tolerance for shade and decrease under grazing, especially by cattle. Occasionally they develop high coverages in full sunlight. These *Agropyrons* are considered alternate indicators of the BRCA group. *Agropyron spicatum* occurs naturally in the PSME/SPBE h.t., while *A. intermedium* results from direct seeding. Like most grasses, *Bromus* and *Agropyron* store little or no seed in the soil (Kramer 1984; Strickler and Edgerton 1976).

The BRCA layer group is relatively uncommon in PSME/SPBE, because many sites receive some grazing. Also, some minor environmental variation within the habitat type may be limiting BRCA layer types, but this relationship is unclear. To date only three of the eight possible layer types have been found (fig.16). Most BRCA layer types that have been sampled occur on sites that were clearcut and well scarified and receive little or no grazing. BRCA layer types often have higher forage values than other herb layer types in the PSME/SPBE h.t. but are easily converted to POGL layer types by grazing.

***POTENTILLA GLANDULOSA* LAYER GROUP (POGL L.G.)**

The perennial forb, *Potentilla glandulosa,* is nonrhizomatous and intolerant of shade. In full sunlight it flowers readily, producing large numbers of seeds that store in the soil (Kramer 1984). The seeds often germinate profusely following scarification from mechanical treatment or livestock. *Potentilla* seems to be less palatable to livestock than most associated herbs; it increases under grazing and can become the only species that is well represented on the site. This response is most evident following heavy sheep use of areas with granitic soils.

Carex rossii is a nonrhizomatous sedge that stores its seed in the soil or duff (Kramer 1984). It germinates readily following scarification but responds poorly to burning. On thoroughly scarified sites, *Carex rossii* can dominate the herb layer, remaining well represented until replaced by taller species. In spring it provides some forage for large herbivores. In the PSME/SPBE h.t., *Carex rossii* usually associates with *Potentilla*; the *Potentilla* tends to be more common.

When well represented, the above species indicate early stages of herb layer succession. POGL layer types are common in the PSME/SPBE h.t., resulting mainly from scarification. Bulldozer-piling operations are the most common cause of POGL layer types, but extensive skidding or livestock use can produce similar vegetation. All samples of the POGL-POGL layer type resulted from intensive machine scarification, often followed by cattle grazing. The POGL-CAGE layer type resulted from scarification or broadcast burning. Sometimes these burns were in frost pockets that precluded ILRI layer types. Most sample stands had been disturbed 5 to 25 years ago (appendix B). Pocket gophers are often prevalent in these herb layers, particularly in the

PIPO phase, but other wildlife values appear low. These POGL layer types may persist until a tree or shrub layer begins to shade the site, or they may progress to a GEVI layer type in full sun. In either case, the more advanced herb layer generally has less appeal to pocket gophers.

ILIAMNA RIVULARIS LAYER GROUP (ILRI L.G.)

Iliamna rivularis is a nonrhizomatous, early seral perennial that can store its seed in the soil for long periods (Kramer 1984). This species can become well represented by germinating from buried seed after intense broadcast burns or where slash has been piled and burned. It may also appear following high-intensity wildfire, even germinating in severely burned areas where vegetation has been reduced to white ash. This strategy gives *Iliamna* a competitive advantage over species having wind-borne seeds, which are usually much smaller and less concentrated on the site. *Iliamna* grows quickly following germination and provides highly palatable forage for elk and sheep during the summer. By the second growing season it can bloom profusely, adding pleasing color to the landscape.

ILRI layer types are scarce in PSME/SPBE (fig. 16) but could become more common wherever there is intense burning. However, burning in frost-prone areas is not likely to produce ILRI layer types. These layer types can be short-lived under livestock grazing, which causes them to change to a POGL layer type. Succession also replaces ILRI layer types rather quickly once they are shaded by shrubs or trees.

GERANIUM VISCOSISSIMUM LAYER GROUP (GEVI L.G.)

Geranium viscosissimum is a nonrhizomatous forb that has some tolerance for light shade. It apparently increases wherever grazing, especially by sheep, has been reduced; it is often a notable component of ungrazed forb communities in early seral condition. Apparently *G. viscosissimum* has limited ability to store its seed in the soil and duff (Kramer 1984).

Castilleja miniata is a forb with a woody base and some tolerance for light shade and grazing. In PSME/SPBE it occasionally develops relatively high coverages in lightly grazed stands of patchy timber or scattered tall shrubs. *Castilleja applegatei* strongly resembles *C. miniata* and may also be present on some of these sites. Both species are considered a successional equivalent of *Geranium*.

Balsamorhiza sagittata is a deep-rooted nonrhizomatous forb that has some tolerance for light shade. Occasionally it remains well represented in early to midseral stages of succession in the PSME/SPBE h.t. Like *Geranium*, *Balsamorhiza* has only limited ability to store its seed in the soil and duff (Krygier 1955) and is considered to be successionally equivalent to *Geranium*.

Penstemon attenuatus is a forb with a woody base that forms tufts or small mats from a rhizome-caudex. It apparently can increase under light grazing and under light shade but requires bare soil for establishment. Occasionally it becomes well represented in the PSME/SPBE h.t. Its successional amplitude appears to be similar to that of *Geranium*; therefore, it was included in the GEVI layer group.

Aster perelegans is a nonrhizomatous forb that occasionally becomes well represented in the PSME/SPBE h.t. Since its tolerance for shade and grazing appears to be similar to that of *Geranium*, it was included in this layer group.

Epilobium angustifolium is a rhizomatous perennial with wind-borne seed. In openings created by stand-destroying wildfires, it can form extensive colonies either from seed or from rhizomes that survive the fire (Stickney 1985). Apparently, *Epilobium* seed does not store in the soil (Kramer 1984). In full sunlight *Epilobium* will bloom profusely, providing color to the landscape. It is also highly palatable to deer, elk, and sheep and is a major nectar source for hummingbirds. It is most productive in full sun but can persist in a nonflowering condition beneath partial shade. Because *Epilobium* appears only occasionally in the PSME/SPBE h.t., it was included in the GEVI layer group as an indicator of midseral herb layers.

Bromus inermis is a rhizomatous grass that usually results from direct seeding. It can develop high coverages on ungrazed sites. Like most grasses, *B. inermis* stores little or no seed in the soil (Kramer 1984; Strickler and Edgerton 1976). Originally it was thought to be an early seral species, but additional observations indicate that it is midseral and probably a successional equivalent in this layer group.

GEVI layer types represent midseral stages of herb layer succession. They may occur in ungrazed areas that have been clearcut and scarified; usually they result from successional advance of POGL layer types that were themselves the result of scarification. Most GEVI layer types appear to be progressing toward APAN, CAGE, and CARU layer types as the amount of shade or competition increases. The GEVI layer group contains five possible layer types, four of which were found (fig. 16). All the sampled plots had been clearcut or partially cut and scarified 8 to 25 years earlier. A few had also been broadcast burned.

APOCYNUM ANDROSAEMIFOLIUM LAYER GROUP (APAN L.G.)

Apocynum is a rhizomatous forb that can develop substantial coverage in full sun or partial shade. Because it is highly unpalatable to livestock, it can withstand light to moderate grazing. It is also highly toxic to pocket gophers (Okello 1993). There is no indication that *Apocynum* can store its seed in the soil (Kramer 1984).

Veratrum californicum is a tall, rhizomatous forb that can maintain substantial coverages beneath partial shade. Like *Apocynum* it can withstand light to moderate grazing because it is not palatable to livestock. Black bears, however, will eat the thick shoots in late spring. *Veratrum*'s ability to store seed remains unknown. Occasionally it becomes well represented in PSME/SPBE and is considered an alternate indicator of the APAN layer group.

The APAN layer group occurs only in the PIPO phase, probably reflecting the warmer conditions that occur in that phase. APAN layer types appear to have evolved from early seral layer types rather than directly from a particular disturbance. However, the early seral conditions that give rise to APAN layer types result mainly from scarification and grazing (fig. 19). The grazing pressures often continue as shade increases, leaving an APAN layer type on the site. Sometimes these layer types occur on recently disturbed sites; in such cases they appear to have survived the disturbance rather than resulted from it.

FRAGARIA VESCA LAYER GROUP (FRVE L.G.)

Fragaria vesca and *F. virginiana* can develop substantial coverages through their stoloniferous growth habit. This occurs most often beneath a light canopy of trees or tall shrubs where partial shade has reduced competition from early seral herb layer species. In clearcut areas that have developed a shrub layer, *Fragaria* often displays high coverages beneath the canopies of large shrubs. The shrub interspaces support species such as *Potentilla* and *Geranium* that tend to be indicative of disturbance

Figure 19—An APAN-APAN herb layer type east of Idaho City, ID, in 1985. This area last burned in about 1889. It was logged in 1933 and has been grazed by sheep intermittently. *Apocynum androsaemifolium* responded to scarification from the logging and has been maintained by the grazing. It now dominates the herb layer.

and full sunlight. *Fragaria virginiana* occurs mainly on the cooler and more frost-prone areas of the habitat type. It is treated as a successional equivalent to *F. vesca*. Small amounts of *Fragaria vesca* seed will remain viable in the soil (Kramer 1984), but most of the seed is likely to be dispersed by birds and mammals. Apparently the seedlings require bare, shaded soil for establishment. *Fragaria* is moderately palatable to deer, elk, and sheep. It remains green through the winter and is more valuable as forage than most herb layer species during that season. The fruits ripen in midsummer and are sought by black bear, grouse, and various songbirds.

FRVE layer types were common in the PIPO and CARU phases of the PSME/SPBE h.t. but were scarce in the SPBE phase. These sites had been clearcut or partially logged 15 to 25 years earlier. Most had been scarified; a few had been burned. It appears that FRVE layer types do not result from a particular disturbance but are simply a midseral stage of herb layer succession following various disturbances. It is not likely that FRVE layer types can be created directly from site treatment but might be maintained through repeated partial cutting.

CAREX GEYERI LAYER GROUP (CAGE L.G.)

Carex geyeri is a moderately shade-tolerant sedge found in many habitat types. It tends to grow in a bunch form, especially on dry granitic substrates; it also develops a loose, rhizomatous form on moister sites. Its extensive root system is an effective soil stabilizer even on steep granitic slopes. It is a strong competitor with other plants, including tree seedlings. *Carex geyeri* has some ability to store seed in the soil (Kramer 1984). The stored seed apparently germinates best following clearcutting and scarification, but can also germinate following burning. Burning appears to reduce the sedge cover but not as much as mechanical scarification. In spring *C. geyeri* is one of the first plants to produce new growth with considerable forage value for elk and bear (appendix B). The ability to grow under low spring temperatures enables *C. geyeri* to deplete soil moisture (and then go dormant) before other plants can make use of the moisture. This *Carex* generally persists in older stands but with increasing shade gives way to its common associates: *Calamagrostis rubescens* and *Arnica*. For this reason *C. geyeri* represents late seral stages of herb layer succession. It may occupy a climax role in the SPBE phase of the PSME/SPBE h.t. and near the dry extremes of the PIPO phase.

Aster conspicuus is a moderately shade-tolerant forb that can maintain extensive colonies beneath pine and Douglas-fir. When the tree canopy is reduced, *A. conspicuus* can increase by rhizomes and develop high coverages. It can also increase following a wildfire and is one of the first herb layer species to resprout after a severe burn. Its windborne seed provides long-distance dispersal and probably germinates on bare soil. In this manner, small amounts of *Aster* can establish after stand-destroying wildfires or clearcutting with scarification, increasing vegetatively afterward to form extensive colonies. These colonies persist on well-timbered sites, which makes *A. conspicuus* successionally similar to *Carex geyeri* as an indicator of late seral conditions.

Poa nervosa is a shade-tolerant, rhizomatous grass that is common on sites in the PSME/SPBE h.t. It often occurs as small patches reproducing vegetatively under mature canopies of *Pseudotsuga*; with increased sunlight, it can expand its coverage and flower. This response is most apparent following thinnings and shelterwood cuts where it increases more rapidly than *Carex geyeri* and occasionally becomes well represented. Because it can persist along with *C. geyeri* under mature tree canopies where neither species is well represented, it is considered an indicator of late seral conditions.

Several species of *Lupinus* can become well represented in the PSME/SPBE h.t., but *Lupinus caudatus* and *L. sericeus* are the primary species. Seldom are the species mixed, and the occurrence of each appears related to minor site differences. All of these lupines are nonrhizomatous, deep-rooted perennials. They produce a relatively heavy seed that is probably not widely dispersed and is likely stored in the soil. Their deep taproots enable them to survive most forms of disturbance. When the tree canopy is removed by fire or logging, the lupines increase their cover in response to increased sunlight and decreased competition. Some buried seed may sprout, contributing to increased coverage of lupine. Lupines' ability to persist on well-timbered sites makes them successionally similar to *Carex geyeri* as an indicator of late seral conditions.

CAGE layer types are prevalent in the PIPO, CARU, and SPBE phases of the PSME/SPBE h.t. They occur on sites that have been disturbed as recently as 6 years earlier, as well as on sites undisturbed for nearly a century. Most of the more recently disturbed sites (those disturbed up to about 20 years earlier) had been clearcut or partially cut, as well as scarified; a few sites had been broadcast burned. The remaining sites had experienced a wildfire in the distant past. Where these sites occur at the dry extreme of the PSME/SPBE h.t., the CAGE layer types probably represent a climax herb layer. On the moister sites it appears that CAGE layer types can result from light scarification of *Calamagrostis* sod under partial shade. This response was most common on granitic substrates but also occurred on sedimentary sites.

CALAMAGROSTIS RUBESCENS LAYER GROUP (CARU L.G.)

Calamagrostis rubescens is a rhizomatous grass that can maintain high coverages under fairly dense shade. With increased sunlight the *Calamagrostis* can acquire new vigor and increase its coverage. This response is most likely to occur in moister portions of the habitat type. At its dry extremes *Calamagrostis* does not always increase with increased sunlight and on sites in full sun, minor scarification may even reduce the coverage of *Calamagrostis*. It has a wind-borne seed that provides long-distance dispersal; the seed germinates on bare soil. This allows *Calamagrostis* to establish on a severe burn or a scarified clearcut, later spreading by rhizomes to form an extensive colony. The seed is not known to store in the soil (Kramer 1984). *Calamagrostis* has high spring-summer forage value for black bear and elk (appendix B).

Arnica cordifolia is a shade-tolerant, rhizomatous forb that can develop substantial coverages in clearcuts or open stands of timber. However, on most sites in the PSME/SPBE h.t., *Arnica* displays low coverages beneath a shrub or tree canopy; it persists in moderate shade more successfully than most herb layer species. It shows little ability to increase from seed following any type of disturbance and, like most wind-dispersed species, does not store its seed in the soil (Kramer 1984). *Arnica* increases most effectively from residual plants following partial cutting without scarification and has moderate forage value for deer and elk (appendix B). Its high degree of shade tolerance makes *Arnica* a successional equivalent of *Calamagrostis*.

Thalictrum occidentale is a shade-tolerant, rhizomatous forb that occasionally produces high coverages in older stands of the PSME/SPBE h.t. In some areas *Thalictrum fendleri* may be present instead of *T. occidentale*; we include it with *T. occidentale*. No other species in the herb layer appears capable of replacing *Thalictrum* without the aid of disturbance. *Thalictrum* can be reduced by moderate scarification, burning, or in some cases, just by removal of the tree canopy. *Thalictrum* does not appear to store its seed in the soil (Kramer 1984); it has moderate forage value for deer and sheep (appendix B).

The CARU l.g. consists of only one layer type; it is considered climax wherever found in the PSME/SPBE h.t. This layer type generally results from successional advance rather than a particular site treatment. However, an ineffective site treatment may allow a CARU layer type to remain intact, creating a difficult situation for tree regeneration. Most sites with the CARU-CARU layer type had experienced little or no disturbance for many decades. A few sites had been burned recently, but the *Calamagrostis* and *Arnica* simply resprouted. Most of these sites were receiving little or no livestock use.

MANAGEMENT IMPLICATIONS

The following implications for management were derived from data and repeated field observations during this study. In some cases implications were also derived from habitat type studies (Steele and others 1981, 1983). Users of the following information should keep in mind that the samples were often small and that field testing and user response has been minimal. Yet trends reflected by these data appear logical and seem adequate to support interpretations that recognize the information's limitations.

Natural Tree Establishment

Naturally established tree seedlings were recorded by species, silvicultural treatment, and microsite conditions. A seedling was defined as a tree less than 4.5 feet (1.4 meters) tall, at least 3 years old, but younger than the disturbance. Silvicultural methods follow Smith (1962) with tree species composition and average canopy covers shown in table 9. The canopy covers shown for seed-tree cuts (table 9) are higher than the actual cover because sample plots subjectively included seed trees.

A total of 409 naturally established *Pinus contorta*, *Pinus ponderosa*, and *Pseudotsuga menziesii* seedlings were recorded in seedling plots in the three phases of the PSME/SPBE h.t. This represented 387 seedlings per acre (958 per hectare) in the PIPO phase, 923 seedlings per acre (2,286 per hectare) in the CARU phase, and 590 seedlings per acre (1,461 per hectare) in the SPBE phase (table 9). Because of the sparsity of data for the SPBE and CARU phases of the PSME/SPBE h.t., the data for all three phases were combined for *Pinus contorta* and *Pseudotsuga* seedling summaries.

Seedbeds and covers comprise the major microsite components for natural regeneration. The amount of a particular seedbed or cover varies depending on the area occupied by individual microsite components. Ratio analysis (Groot 1988) was used to determine the regeneration efficiency (RE) values of seedlings in different microsites. To calculate the RE value (a ratio), the percentage of seedlings occurring on or under a microsite component was divided by the percent of the area occupied by the component. An RE value of 1.00 indicates that the seedlings occurred in a particular microsite in proportion to the occurrence of that microsite. RE values are assigned to one of five classes: class 1: 0 to 0.25, very inefficient; class 2: 0.26 to 0.75, inefficient; class 3: 0.76 to 1.50, efficient; class 4: 1.51 to

Table 9—Occurrence of natural tree seedlings (percent) by silvicultural method and overstory composition for the PSME/SPBE h.t., PIPO,[1] CARU, and SPBE phases

Silvicultural method Overstory composition	Number of sites	Present tree cover[2]	Average distance to seed source[3]	Average distance to seed source for plots with seedlings	Present basal area	Natural tree seedlings *Pinus contorta*	Natural tree seedlings *Pinus ponderosa*	Natural tree seedlings *Pseudotsuga menziesii*
		Percent	*Feet*	*Feet*	*Square feet*	*Seedlings per acre*	*Seedlings per acre*	*Seedlings per acre*
PSME/SPBE h.t.								
PIPO phase						35	181	171
CARU phase						648	—	275
SPBE phase						58	—	532
						Percent	*Percent*	*Percent*
Clearcut	40				13	15	11	29
Pinus contorta		<1	48	42				
Pinus ponderosa		8	145	123				
Pseudotsuga menziesii		<1	112	91				
Seed-tree cut	9				69	0	12	20
Pinus contorta		0	[4]100	—				
Pinus ponderosa		19	90	19				
Pseudotsuga menziesii		3	86	46				
Shelterwood cut	17				71	73	64	21
Pinus contorta		1	45	10				
Pinus ponderosa		17	25	30				
Pseudotsuga menziesii		9	49	55				
Selection cut[5]	9				41	12	13	30
Pinus contorta		1	[4]15	—				
Pinus ponderosa		13	73	63				
Pseudotsuga menziesii		8	44	25				

[1]Results for *Pinus ponderosa* are only calculated from data for the PIPO phase.
[2]Percent canopy cover of trees >4 inches d.b.h.
[3]Distance from center of 375-square-meter plot to seed source; overstory often comprised of immature trees.
[4]Data from only one plot.
[5]Includes single tree selection cuts and small group selection cuts of two to five trees per group.

3.00, more efficient; class 5: 3.01 and greater, very efficient. Other summaries, including occurrence of seedlings under various silvicultural methods, site preparation methods, and tree and shrub layer groups, are expressed as percent occurrence for a species based on the average number of seedlings per treatment.

Microsites for natural regeneration were determined after germinants had become established. From this study, we could not determine the exact conditions in which the seedling established; however, Groot (1988) determined that ratio analysis is feasible on sites where seedbeds do not change much through time. In our study the seedbed categories were bare mineral soil, litter-covered mineral soil, moss mats, rotten wood, and residual duff. Bare mineral soil, rotten wood, and residual duff seedbeds probably would not change much between disturbance and the time seedling microsites were recorded. We could not determine, however, what the seedbed conditions might have been when seedlings became established on seedbeds now composed of litter-covered mineral soil or moss mats. The litter may retard soil surface evaporation rates; some investigations have shown that litter-covered mineral soil may be important, particularly in dry environments, as a seedbed for regeneration (Day and Duffy 1963; Krauch 1956). Moss mats also have properties indicating they may enhance seedling germination and establishment (Day and Duffy 1963).

The relationship between microsite covers and seedling establishment was much more difficult to determine. The microsites of seedlings found without covers or under slash were likely to have been the same microsites in which the seed germinated. In the case of seedlings under vegetation cover, however, tree seedlings and the microsite cover may have benefited from the same initial microsite conditions, establishing near one another coincidentally. In other cases, the tree seedling may have benefited from the existing cover, which may have provided more favorable microsite conditions in terms of shade, soil moisture and nutrients, humidity, temperature, and wind protection (Zavitkovski and Woodard 1970). Natural regeneration investigations in other areas have found that some vegetation species, including conifers, require protected microsites for germination and initial establishment, particularly in hot, dry environments (Day 1964; Everett and others 1986; Minore 1986, 1987; Roeser 1924). Additionally, some microsite covers may favor one seedling species but not another. A heavy canopy cover may favor shade-tolerant tree species, or an allelopathic cover species may deter establishment of certain tree seedling species. Where a positive seedling-microsite relationship exists, the canopy cover species may either enhance natural regeneration establishment or indicate favorable microsites. Where a negative relationship exists, canopy cover species may indicate unfavorable microsites.

Although RE values may reflect a relationship between the microsite and tree seedlings, several factors affect the interpretation of these values. We assumed that seedlings persist only in favorable microsites; if a seed germinates in a favorable microsite, and the microsite deteriorates, through rapid shrub development, for instance, the seedling may die. Some seedlings recorded in unfavorable microsites may have died afterward. Therefore, some microsites identified as beneficial may not allow seedlings to develop to mature trees.

Pinus contorta—Most of the natural regeneration of *P. contorta* occurred in the PSME/SPBE h.t., CARU phase (table 9). In the PIPO and SPBE phases, seedling occurrence was low even when seed sources for *P. contorta* were present nearby. The majority of the seedlings (73 percent) occurred under shelterwood cuts (table 9) that had been lightly scarified either from slash piling operations or logging activities (table 10). Most of the remaining seedlings were found in lightly scarified or burned clearcuts or selection cuts. Moss mats, which occurred infrequently in the PSME/SPBE h.t., had

Table 10—Occurrence of natural tree seedlings (percent) by site preparation method for the PSME/SPBE h.t., PIPO[1], CARU, and SPBE phases

	Site preparation method			
			Scarification	
Species	None	Prescribed burn	Light[2]	Heavy[3]
Percent of sampled sites	7	20	51	23
Pinus contorta	0	27	73	0
Pinus ponderosa	38	10	43	9
Pseudotsuga menziesii	19	47	25	9

[1]Results for *Pinus ponderosa* are only calculated for the PIPO phase.
[2]Scarification from slash piling or logging activities.
[3]Disturbance from logging activities and contour terracing or stripping.

the highest regeneration efficiency for *P. contorta* (table 11). The most common seedbed, scarified and litter-covered mineral soil, was an efficient seedbed for *P. contorta*; scarified and bare mineral soil was inefficient. No *P. contorta* seedlings were found on rotten wood or residual duff.

Most *P. contorta* seedlings (70 percent) occurred in the open away from the cover of grasses and sedges, the predominant microsite covers on the site (not including the overstory) (table 12). *Pinus contorta* was a very efficient cover for *P. contorta* seedlings, slash was efficient, and *Spiraea betulifolia* was inefficient. In terms of tree canopy cover, most seedlings (69 percent) were found under a PICO tree layer group (table 13). For the shrub layer, most of the seedlings (80 percent) were found on sites with an SASC shrub layer group, although no seedlings were found under *Salix*. SASC layer groups usually develop on moister sites in the PIPO and CARU phases of the PSME/SPBE h.t.; this may account for the larger number of *P. contorta* seedlings in this layer group compared to other layer groups.

Pinus contorta occurs primarily in the CARU phase of the PSME/SPBE h.t., and appears to require some site protection from an overstory (Steele and Geier-Hayes 1993). Open shelterwood cuts of 10 to 30 trees per acre should regenerate well to *P. contorta* seedlings. Shelterwood cuts should be lightly scarified to provide mineral soil over 60 to 70 percent of the area. Openings created by clearcutting or group selection cutting should be lightly scarified or burned. Scarification treatments often encourage moss mats, which were a very efficient seedbed for *P. contorta*.

Pinus ponderosa—Regeneration of *P. ponderosa* occurred primarily (64 percent) under shelterwood cuts where the average distance to a seed source was just 25 feet (8 meters) (table 9). Seedlings were found in approximately equal proportions under selection cuts, seed-tree cuts, and clearcuts, even though the average distance to a seed source ranged from 73 feet (22 meters) for selection cuts to 145 feet (44 meters) for clearcuts. The large numbers of seedlings under shelterwood cuts may be due either to the proximity of the seed source, to the ameliorated environment created by the overstory, or to a combination of those factors.

Most of the *P. ponderosa* seedlings were found on sites that had been lightly scarified (43 percent) or had received no site preparation (38 percent) (table 10), even though no *P. ponderosa* seedlings were found on residual duff (table 11). Few seedlings were found on burned sites (10 percent) or sites with heavy scarification (9 percent). Moss mats were a very efficient seedbed for *P. ponderosa* seedlings, while scarified and litter-covered mineral soil and rotten wood were efficient. A third of the seedlings occurred in the open (table 12). *Purshia tridentata*, *Artemisia tridentata*, and *Spiraea betulifolia* are more efficient covers for *P. ponderosa* seedlings. Slash, *Ceanothus*, and *Salix* are efficient. Even though *P. ponderosa* was an inefficient microsite cover, most seedlings were found under shelterwoods, particularly shelterwoods in the PIPO layer group (table 13). For the shrub layer groups, seedlings were found under all shrub layers except the RICE layer group (table 13).

On some sites seed caches may play an important role in *Pinus ponderosa* establishment. In the Oregon Cascade Range, West (1968) found that 15 percent of the *P. ponderosa* seedlings resulted from rodent caches. McConkie and Mowat (1936) reported a similar proportion in central Idaho (14 percent). Medin (1984) indicated that the yellow pine chipmunk (*Eutamias amoenus*) may be responsible for many of the caches found in central Idaho, though Clark's nutcracker (*Nucifraga columbiana*) may also

Table 11—Regeneration efficiency classes[1] of seedbeds for natural tree seedlings in the PSME/SPBE h.t., PIPO, CARU, and SPBE phases

Species	Mineral soil: Scarified and litter-covered	Mineral soil: Scarified and bare	Moss mats	Rotten wood	Residual duff	Rocks or stumps
	Regeneration efficiency					
Pinus contorta	3	2	5	—	—	—
Pinus ponderosa[2]	3	2	5	3	—	—
Pseudotsuga menziesii	3	2	5	4	—	—
	Percent					
Seedbed occurrence[3]	53	40	2	1	3	1

[1]Regeneration efficiency classes: 1 = 0-0.25, very inefficient; 2 = 0.26-0.75, inefficient; 3 = 0.76-1.50, efficient; 4 = 1.51-3.00, more efficient; 5 = 3.01+, very efficient.
[2]Data for *Pinus ponderosa* are only from the PIPO phase.
[3]Percent occurrence of seedbed in all plots.

Table 12—Regeneration efficiency classes[1] of shrub cover and other microsites for natural tree seedlings in the PSME/SPBE h.t., PIPO, CARU, and SPBE phases

Type of cover	Area occupied	Constancy	*Pinus contorta*	*Pinus ponderosa*[2]	*Pseudotsuga menziesii*
	Percent		Regeneration efficiency		
None[3]	—	—	—	—	—
Grasses and sedges	18	99	—	1	—
Symphoricarpos oreophilus	15	33	—	1	1
Spiraea betulifolia	13	90	2	4	4
Forbs	13	99	—	—	2
Pinus ponderosa	9	34	—	2	3
Slash	8	55	3	3	3
Ceanothus velutinus	6	30	—	3	3
Amelanchier alnifolia	3	25	—	1	3
Prunus emarginata	3	17	—	2	1
Berberis repens	3	38	—	—	2
Sorbus scopulina	3	2	—	—	—
Prunus virginiana	2	18	—	—	1
Pinus contorta	1	6	5	—	4
Salix scouleriana	1	6	—	3	3
Pseudotsuga menziesii	1	6	—	2	2
Purshia tridentata	1	8	—	4	3
Artemisia tridentata	<1	3	—	4	2
Populus tremuloides	<1	3	—	—	—
Ribes viscosissimum	<1	5	—	—	2
Ribes cereum	<1	5	—	—	—
Rosa spp.	<1	9	—	—	—
Acer glabrum	<1	2	—	—	—
Physocarpus malvaceus	<1	2	—	—	—
Rubus parviflorus	<1	1	—	—	—
Symphoricarpos albus	<1	4	—	—	—
Lonicera utahensis	<1	2	—	—	—
Sambucus racemosa	<1	1	—	—	—

[1]Regeneration efficiency classes: 1 = 0-0.25, very inefficient; 2 = 0.26-0.75, inefficient; 3 = 0.76-1.50, efficient; 4 = 1.51-3.00, more efficient; 5 = 3.01+, very efficient.
[2]Data for *Pinus ponderosa* are taken only from the PIPO phase.
[3]During sampling no estimate for "none" type of cover was made for each plot; therefore, no regeneration efficiency value could be calculated. However, 70 percent of the *Pinus contorta*, 33 percent of the *Pinus ponderosa*, and 16 percent of the *Pseudotsuga menziesii* were found under no cover.

be involved (Giuntoli and Mewaldt 1978; Lanner 1980). In the *Pseudotsuga menziesii/Acer glabrum* h.t., 31 percent of the regeneration apparently established from seed caches (Steele and Geier-Hayes 1989a). In the *Pseudotsuga menziesii/Carex geyeri* h.t., *Pinus ponderosa* phase, 22 percent of the *P. ponderosa* regeneration occurred in seed caches (Steele and Geier-Hayes 1987b). The occurrence was similar in the *Abies grandis/Vaccinium globulare* and *Abies grandis/Acer glabrum* habitat types (17 percent) (Geier-Hayes 1987). In the PSME/SPBE h.t., PIPO phase, 11 percent of the *P. ponderosa* seedlings were found in seed caches.

Selection of a silvicultural method for natural regeneration of *Pinus ponderosa* should first address the proximity of *P. ponderosa* seed sources within the stand. Shelterwood cuts may be necessary to ameliorate site conditions. Seedlings would likely regenerate on sites that had either been scarified or underburned. Small quarter-acre or half-acre openings that are broadcast burned may also regenerate *P. ponderosa*. *Ceanothus,* which establishes quickly after burning, was an efficient cover species for *P. ponderosa* seedlings. Most regeneration is likely to occur within 100 feet (30 meters) of the seed source. The sites should be treated so that mineral soil occurs over 80 to 90 percent of the area.

Pseudotsuga menziesii—Occurrence of natural regeneration of *Pseudotsuga* was similar for the different silvicultural methods even though the average distance to a seed source varied from 44 feet (13 meters) for selection cuts to 112 feet (34 meters) for clearcuts (table 9). While seedlings were found on sites with and without overstory cover, only 16 percent of the seedlings were found in the open (table 12);

Table 13—Occurrence of natural tree seedlings by tree and shrub layer groups in the PSME/SPBE h.t., PIPO,[1] CARU, and SPBE phases

Layer groups	Percent of stands	Tree seedlings *Pinus contorta*	*Pinus ponderosa*	*Pseudotsuga menziesii*
		Percent		
Tree layer groups				
Depauperate	31	3	18	24
POTR	1	25	0	16
PICO	8	69	0	23
PIPO	49	3	69	18
PSME	11	0	13	19
Shrub layer groups				
Depauperate	3	0	20	0
ARTR/PUTR	8	0	18	12
CEVE	31	8	21	12
RICE	3	0	0	2
SASC	5	80	7	6
PRVI	19	0	5	3
AMAL/SYOR	15	0	20	48
SPBE	16	11	9	17

[1]Data for *Pinus ponderosa* are only from PIPO phase.

almost half of the seedlings were found on sites that had received prescribed burns (broadcast burns or underburns) (table 10). Seedlings were also found on sites that had received light scarification (exposure of mineral soil) and on sites without site preparation, even though no *Pseudotsuga* seedlings were found on residual duff (table 11). Moss mats were a very efficient seedbed, followed by rotten wood, which was more efficient. Scarified mineral soil covered with new litter was efficient, but scarified exposed mineral soil was inefficient.

Several microsite covers were more efficient or efficient for *Pseudotsuga* including slash, *Spiraea*, *Pinus contorta*, *P. ponderosa*, *Ceanothus*, *Amelanchier*, *Salix*, and *Purshia*. No tree layer group produced more seedlings than another (table 13). In the shrub layer the AMAL and SYOR shrub layer groups accounted for almost half of the *Pseudotsuga* natural regeneration (table 13). *Amelanchier* was an efficient cover for *Pseudotsuga* seedlings; however, *Symphoricarpos* was a very inefficient cover. Seedlings occurred under all the shrub layer groups; no seedlings were found on sites without a shrub layer, though occurrence of seedlings was low in the RICE and PRVI shrub layer groups.

Lightly scarified or underburned shelterwood cuts with 30 to 40 live trees per acre should regenerate *Pseudotsuga* seedlings. Openings created by clearcutting or group selection cuts should also regenerate if seed sources are available within 200 feet (61 meters); however, openings should be burned to encourage the growth of shrubs to protect the site. Treatments that expose mineral soil over 80 to 90 percent of the area should provide a variety of seedbeds for *Pseudotsuga*, including moss mats and litter-covered mineral soil.

Planted Tree Establishment

Occurrences of planted trees were determined in the field from plantation signs and obvious rows of even-age trees. The success of tree plantations was recorded in terms of estimated percent survival and site preparation. The kinds of site preparation encountered included no preparation, hand scalps, scarification with and without burning, and contour terraces and ditches. Data from hand scalps were grouped with no preparation, because the former often had little effect in reducing long-term competition, and because hand scalps could not always be recognized in older plantations. Scarification treatments usually resulted from contour stripping, bulldozer-pile and burn operations, or extensive machinery traffic during the logging operation. The effects of contour stripping resemble bulldozer-pile and burn operations more than contour terracing; the top layer of soil is scraped but not pushed aside where it could collect moisture. Contour terraces varied in width from 2 to 3 feet (0.6 to 0.9 meters) on gentler terrain to 6 to 8 feet (1.8 to 2.4 meters) on the steeper slopes. Ideally, the wider terraces were more widely spaced on the slope to reduce erosion. Contour ditches were grouped with contour terraces because they appear to have the same effect on tree

survival. Construction of the ditches, however, displaces less soil than terracing and is most effective in short vegetation layers such as pinegrass, elk sedge, and spirea.

Survival of planted *Pinus ponderosa* (table 14) was greatest (about 74 percent after 17 years) on contour terraces or ditches. These treatments apparently improve the soil moisture regime by collecting runoff and by removing the seed and root crowns of competing plant species. Improved survival of planted pines on contour terraces and ditches has also been noted in other Douglas-fir habitat types (Hall and Curtis 1970; Steele and Geier-Hayes 1989b, 1993). Other site treatments, such as burning and scarification, resulted in substantially lower pine survival than contouring (table 14). These treatments often do not effectively decrease competing vegetation, especially rhizomatous species, long enough for ponderosa pine to become established. In some cases burning increases competition by stimulating shrub growth and germination of buried seeds. In the PSME/SPBE h.t., as in most habitat types, little or no site preparation tends to produce the poorest survival in plantations (table 14).

The survival percentages in table 5 may differ considerably from National Forest records—for two reasons. First, our data reflect planting attempts over many years; many early planting failures were due to factors other than site treatment and habitat type. Second, these data reflect seedling success over the past 10 to 30 years. Since other survival records are generally maintained for only a few years after planting, they do not always reflect the full effects of the site and long-term competition. These percentages should not be construed as the highest possible survival; on occasion, survival has been high in all treatment categories. Realistically, these survival rates are best interpreted as relative probabilities of success rather than the actual survival attainable.

Growth and Yield

Tree growth is of special concern to forest managers. It is important for achieving and maintaining soil stability, site protection, wildlife habitat, and timber production. The most common means of describing tree growth is by age to breast height for seedlings and by site index for larger trees.

Age to Breast Height—The years required for a tree to reach breast height (4.5 feet [1.4 meters]) can be a critical factor in estimating growth and yield

Table 14—Success of tree plantations by site treatment in the PSME/SPBE h.t., PIPO phase

	Site treatment			
Tree species	None, includes hand scalps	Broadcast burning	Scarified, unburned, includes stripping	Contour terraces, includes ditching
	Survival of planting, percent (average age)[1]			
Pinus contorta		0(4) [2]*n* = 1		
Pinus ponderosa	28(22) *n* = 12	33(24) *n* = 10	36(13) *n* = 20	74(17) *n* = 18
Pseudotsuga menziesii	0(15) *n* = 1	Tr(4) *n* = 1	20(4) *n* = 1	
	Average age to breast height, years			
Planted[3]				
Pinus contorta				8 *n* = 1
Pinus ponderosa	12 *n* = 11	8 *n* = 9	9 *n* = 19	8 *n* = 18
Natural				
Pinus contorta		6 *n* = 6		
Pinus ponderosa	12 *n* = 1			
Pseudotsuga menziesii	15 *n* = 1	10 *n* = 2		

[1]Plantings less than 4 years old were omitted; multispecies plantings and complete plantation failures were not sampled.
[2]*n* = the number of plantations sampled.
[3]Nursery years are not included.

parameters of forest stands as well asin relating seedling success to the presence of competing vegetation. Normally an estimated constant is used for a given species regardless of site. Yet for some species sample data have shown considerable variability in breast height ages between habitat types and even between site treatments within a habitat type. In the PSME/SPBE h.t., the breast height age for planted *Pinus ponderosa* is about 8 to 9 years on treated sites (table 14). A lack of site preparation, however, may extend breast height age to 12 years.

Site Index and Yield Capability—Height-age data of free-growing trees, usually in clearcuts or burns, were collected during the course of this study. These data provided growth information for the younger age classes of major tree species in the PSME/SPBE h.t. Similar data in older age classes were taken from dominant or codominant trees in older stands during this study and the habitat type classification study (Steele and others 1981). Increment cores of these older trees were examined for evidence of suppression. If the core indicated past suppression, or if it was too far from the pith to allow a confident estimate of total age, the tree was rejected. The remaining data were used to estimate site index and yield capability.

Three sources were used to estimate site index and yield capability. The *Pseudotsuga* site index was plotted from Monserud's (1985) site curves, but since no yield table exists for *Pseudotsuga*, Brickell's (1970) ponderosa pine yield curve was used. The *Pinus ponderosa* site index and yield capability were derived from Brickell's (1970) site curves, which are a conversion to a 50-year base age from Lynch (1958).

Growth and yield capabilities of the PSME/SPBE h.t. are shown in table 15. Ponderosa pine apparently produces only slightly more volume than Douglas-fir. But if Douglas-fir yield tables were developed, yield capabilities of Douglas-fir might be different.

Pocket Gophers

It has long been known that pocket gophers (*Thomomys talpoides*) can damage pine plantations (Dingle 1956; Moore 1943). Reasons for this damage have been studied at length. In summarizing such studies, Teipner and others (1983) suggest that gopher damage to young pines may be related to the amount and composition of associated plant species as well as to gopher density. Our studies indicate that the type of site preparation can affect species composition, which may influence gopher populations. We tallied pocket gopher mounds in our sample plots as an indication of gopher activity (Richens 1965) and summarized the results by site treatment.

Pocket gophers are common on many disturbed sites in the PSME/SPBE h.t. They occur most frequently in clearcut areas that have been scarified but are also common following broadcast burning (fig. 20). In moister habitat types (Steele and Geier-Hayes 1987b, 1989b) fewer gophers resulted from broadcast burning than from scarification. Apparently this is not the case in the PSME/SPBE h.t. Because burning does not result in such dense shrub layers, gopher foods in the herbaceous layer are not excluded. Consequently, any disturbance that increases the herbaceous layer will likely increase gopher populations in the PSME/SPBE h.t.

Snow Damage to Pine Plantations

Damage to young pines from snowpack movement (as opposed to crown overloading) was noted in parts of the PSME/SPBE h.t. The extent of snow damage within plantations varies from scattered individual trees at lower elevations to virtually all trees at the upper elevations. The damage varies from stripped lateral branches and bent terminals to 90 degree bends in the main stem and even to entire saplings leaning downhill at various angles. Although the young pines can recover from much of

Table 15—Site index and yield capability of tree species in the PSME/SPBE h.t., PIPO phase

Tree species	Number of site trees	Site index (50-year base)	Number of stands	Yield capability
				Cubic feet/ acre/year
Pinus ponderosa	21	[1]58 ± 4	21	76 ± 9
Pseudotsuga menziesii	15	57 ± 4	10	73 ± 7

[1]The 95 percent confidence interval is given.

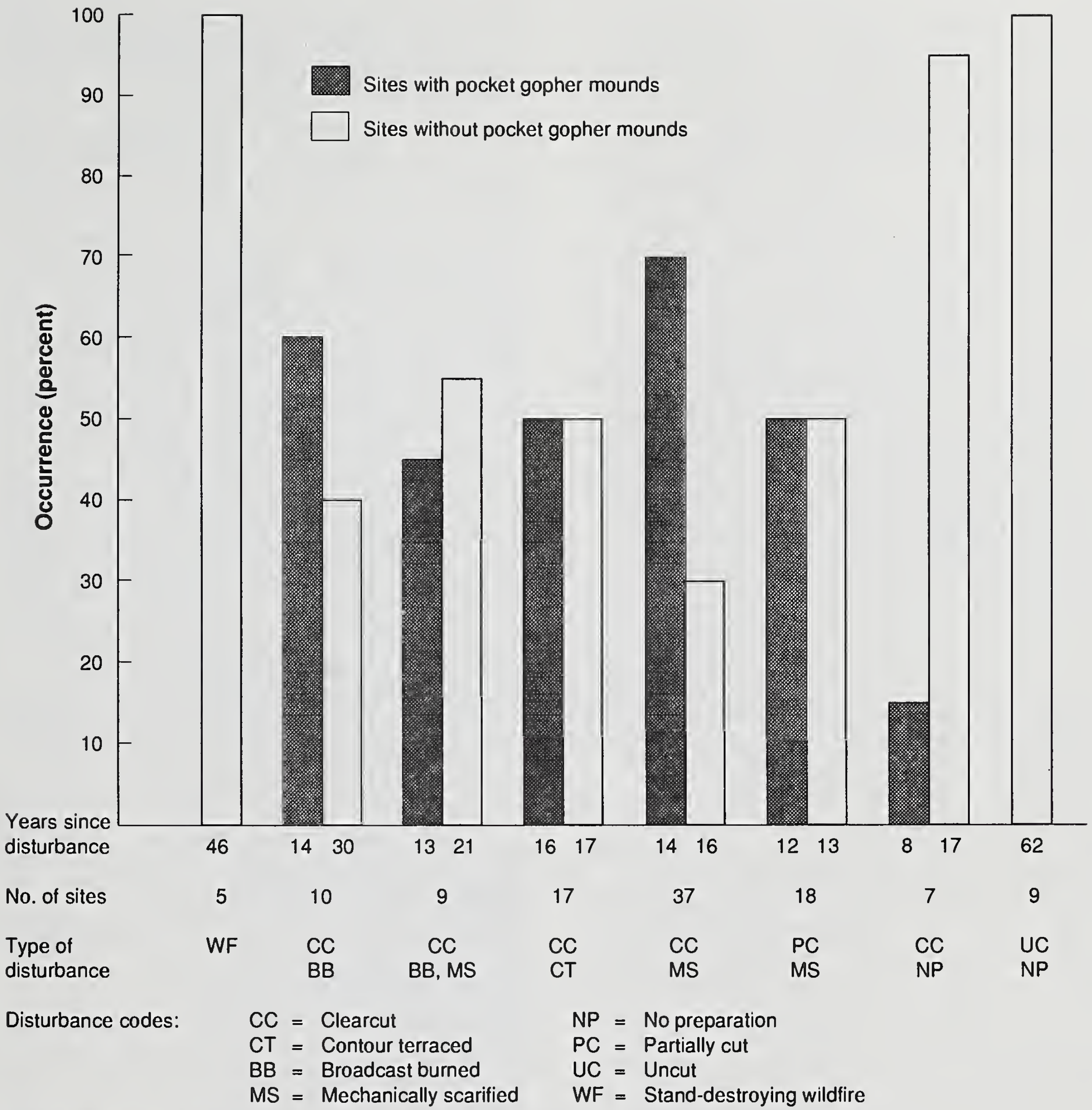

Figure 20—Occurrence of sites with and without pocket gopher mounds following various disturbances in the PSME/SPBE h.t., PIPO phase.

this damage (Oliver 1970), they are often damaged in subsequent years making full recovery unlikely. These saplings are vulnerable to damage from the time they lose flexibility (about 4.5 feet [1.4 meters] in height) until they reach about 4 inches (10.2 centimeters) d.b.h. In the PSME/SPBE h.t., this window of vulnerability lasts about 15 years but can last longer if the pines are shaded by tall shrubs or trees. Long-term snow records indicate that snow damage may occur about every 4 years (Megahan and Steele 1987). As a result the trees are often damaged repeatedly. The trees are not killed unless they are severely damaged or broken, but they grow more slowly (Rehfeldt 1987; Williams 1966), compression wood forms on the downhill side (Panshin and others 1964), and the trees remain vulnerable to shrub competition for longer periods. Occasionally at the highest elevations, the bent, stunted trees are killed by the brown-felt blight (*Neopeckia coulteri*) during years of deep snow and prolonged snowmelt.

Recognizing possible snow damage hazard is important where pine plantations are a management objective. A simple technique for predicting snow damage hazards to pine plantations is now available (Megahan and Steele 1988). This approach uses easily measured site characteristics such as slope, aspect, and elevation, but correctly predicts high-hazard sites only about 74 percent of the time. On questionable sites further consideration may be needed. Sometimes simple field observations can reveal high snow damage potential. The larger, less flexible stems of tall plants such as *Populus* or *Prunus* may show deformities from past snow damage. Highly flexible plants such as *Ceanothus*, *Alnus*, or small *Populus* may show considerable downhill "sweep" to their growth form, and in some timber stands, the bases of trees may be curved downhill showing a "pistol butt" growth form. All of these characteristics are possible indicators of high snow hazard and should be considered when assessing snow damage potential.

Where high snow-hazard sites are identified, some potential damage can be avoided. For instance, pines planted near ridgetops where the snow is not as deep and the snowpack does not move as far, can escape damage. Likewise, plantations that are well shaded in early spring by a nearby ridge or adjacent old-growth stand may escape damage since there is less snow movement in shaded areas. Sites with high stumps and large logs can also reduce snow damage by reducing snow movement. Proper location and treatment of cutting units can exploit these advantages where high damage potential exists.

The genetic source of *Pinus ponderosa* seed is also a critical factor where snow damage hazard exists. Seed sources can vary widely in snow damage susceptibility and recovery (Rehfeldt and Cox 1975). In general, seedlings from lower elevation seed sources tend to grow faster and sustain more snow damage, while upper elevation seed sources grow more slowly and recover from snow damage more readily. However, in some areas the upper elevational limits of ponderosa pine may be due to deep snowpacks rather than low temperatures. Consequently, at upper elevations where the pine occurs naturally in only minor amounts, even pine plantations of the proper seed source may experience reduced stocking levels, and *P. ponderosa* may not be a major component of the stand by rotation age. Selecting seed sources having greater stockiness (Silen and Rowe 1971) may overcome the snow damage problem, but this has yet to be proven.

Vegetation Responses

Our studies indicate that different kinds of disturbance (such as burning or scarification) can produce different kinds of vegetation. This results in different successions with different resource values. It is important to understand these vegetation responses when planning site treatments.

Burning—Broadcast burning and high-intensity wildfire generally result in a CEVE layer type, provided the site is not too cool for *Ceanothus*. Frost-pocket areas and cooler portions of the CARU and SPBE phases generally exclude *Ceanothus* but may support *Shepherdia canadensis*, a successional equivalent. The *Shepherdia* is most likely to appear on benches and dry stream terraces that support *Pinus contorta*. Burned-over areas that do not support *Ceanothus* or *Shepherdia* will likely produce a sparse RICE layer type, or possibly an ARTR layer type, if *Artemisia* communities occur nearby.

Intensely burned areas that support *Ceanothus* will likely produce a dense CEVE-CEVE layer type that can deter livestock and erosion. This is probably the easiest layer type to achieve on slopes with good cold air drainage. Less intense burns will produce the other CEVE layer types (figs. 12, 13, 14), depending on which shrub species dominated the stand before the burn. Most shrub species in the PSME/SPBE h.t. are well adapted to fire and resprout with renewed vigor following burning. *Artemisia*, *Chrysothamnus*, and to a lesser extent *Purshia*, are the main exceptions. The *Purshia* may resprout following low-intensity or spring burns.

Shrubs that resprout following a late summer or fall wildfire often do so that same year, providing succulent forage for deer and elk in late fall. This late-season growth, however, is not sufficiently hardened and will die unless adequate snow cover precedes lethal temperatures. Winter-killed sprouts are common because the PSME/SPBE h.t. often occupies southerly aspects that are slow to accumulate deep snowpacks. If wildlife forage is the management objective, prescribed spring burns may be more beneficial because shrub sprouts would have time to harden.

Scarification—In the PSME/SPBE h.t., PIPO phase, thorough scarification may result in a sparse CEVE layer type; these sites often occupy southerly aspects that accumulate enough heat to stimulate *Ceanothus* germination. A sparse CEVE layer type can provide shelter for natural regeneration of *Pseudotsuga*. Sites that do not support *Ceanothus*, such as frost pockets or much of the CARU and SPBE phases, generally produce ARTR, PUTR, or RICE layer types following scarification. Where scarification has removed the residual shrub species, an ARTR-ARTR or RICE-RICE layer type will likely occur, particularly in the CARU and SPBE phases. A PUTR-PUTR layer type may occur in the PIPO phase, but this layer type takes longer

to develop. These shrub layers have a sparse canopy that does not seriously compete with pine seedlings. If the scarification does not remove the residual shrub species, other ARTR, PUTR, or RICE layer types may result, depending on which shrub species were most prevalent before the scarification. *Spiraea* is particularly difficult to reduce through deep scarification, so RICE-SPBE layer types are relatively common.

Where bulldozer-pile site treatments have been planted to *Pinus ponderosa*, we have repeatedly observed that tree seedlings have grown faster in the piled areas (usually burned) than in the scarified areas. The exact cause of this growth difference remains unknown, because several factors are involved. Soils in the scarified areas may be compacted (Minore and Weatherly 1990); tree growth may be reduced when soils have been compacted (Clayton and others 1987). The scarified areas may have lost most of their organic layer and A horizon, leading to reduced tree growth (Page-Dumroese and others 1991). The piled areas are likely to have gained organic matter and A horizon and also to have escaped soil compaction. They also support more nitrogen-fixing *Ceanothus* due to the burning. Whatever the cause, we do not recommend bulldozer-pile and burn treatments in the PSME/SPBE h.t. because inadequate tree growth often occurs in the scarified areas.

Competition With Tree Seedlings—Potential competition with tree seedlings is a function of existing vegetation, seed availability, site treatment, and habitat type or phase. The habitat type or phase classifies the environment that determines the species that can occupy the site and the magnitude of their potential roles (tables 4, 7). It is not always possible to predict what species will dominate by simply inspecting the site prior to disturbance. Old stands may contain a multitude of early seral species in the form of buried seed (Kramer 1984); other species establish by wind-borne seed. Table 16 lists the major species in the PSME/SPBE h.t. and shows which store seed in the soil, the important

Table 16—Responses of major shrub and herb layer species to various disturbances in the PSME/SPBE h.t.

		Type of disturbance[2]				
Species[1]	Seed transport; reproduction methods	CC NP	SC MS	CC MS	CC BB	WF
Shrubs						
Spiraea spp.	No obvious transport; not stored in soil. Germination requirements unknown. Increases by rhizomes.	[3]V	v	V	V	V
Amelanchier alnifolia	Birds, mammals; not stored in soil. Germinates mainly on mineral soil in partial shade.	v	v-s	v	v	v-s
Symphoricarpos oreophilus	Birds, mammals; not stored in soil. Germinates mainly on mineral soil in partial shade.	v	v-s	v	v	v-s
Prunus spp.	Birds, mammals; stored in soil (27 percent viable)[4]. Germinates in full sun following scarification or burning. Increases by root sprouts.	V	v	V-s	V-s	V-s
Salix scouleriana	Wind; not stored in soil. Germinates on moist mineral soil in full sun following scarification or burning. Stumps resprout vigorously.	V	v	V-s	V-s	V-s
Shepherdia canadensis	Birds, mammals; possibly stored in soil. Germinates on mineral soil in full sun following burning or scarification.	n	d	d-s	S	S
Ribes spp.	Birds, mammals; stored in soil (96 percent viable). Germinates on mineral soil in full sun, mainly following scarification.	n	d	d-S	s	s

(con.)

Table 16 (con.)

Species[1]	Seed transport; reproduction methods	Type of disturbance[2] CC NP	SC MS	CC MS	CC BB	WF
Ceanothus spp.	No obvious transport; seed stored in soil (91 percent viable). Germinates on mineral soil in full sun, mainly following burning.	n	d	d-s	S	S
Purshia tridentata	Rodents; not stored in soil. Germinates on mineral soil in full sun, mainly following scarification.	n	D	D-S	D-s	D-s
Artemisia tridentata	Wind; not stored in soil. Germinates on mineral soil in full sun following burning or scarification.	n	D	D-S	D-S	D-S
Perennial graminoids						
Calamagrostis rubescens	Wind; not stored in soil. Germinates on mineral soil. Increases by rhizomes.	V	d	d	V	V-s
Poa nervosa	Wind; not stored in soil. Germinates on mineral soil. Increases by rhizomes.	V	d	d	V-s	V-s
Carex geyeri	No obvious transport; stores in soil (56 percent viable). Germinates on mineral soil following burning or scarification. Increases by short rhizomes.	n	d-S	d-S	s	s
Carex rossii	No obvious transport; stores in soil (51 percent viable). Germinates on mineral soil in full sun, mainly following scarification.	n	d-s	d-S	s	s
Bromus inermis	Wind (usually direct seeding); not stored in soil. Germinates on mineral soil in full sun. Increases by rhizomes.	V	D	D-s	V-s	V-s
Bromus carinatus	Wind; not stored in soil. Germinates on mineral soil in full sun.	V	D	D-s	v-s	v-s
Agropyron spp.	Wind; not stored in soil. Germinates on mineral soil in full sun.	v	D	D-s	v-s	v-s
Perennial herbs						
Arnica cordifolia	Wind; not stored in soil. Germinates on mineral soil in partial shade. Increases by rhizomes.	n	D-s	D	n	n-s
Aster conspicuus	Wind; not stored in soil. Germinates on mineral soil in partial shade. Increases by rhizomes.	v	d-s	d	V	V-s
Lupinus spp.	No obvious transport; stored in soil (100 percent viable). Germinates on mineral soil in full sun or partial shade.	v	d-s	d-s	v-s	v-s

(con.)

Table 16 (con.)

Species[1]	Seed transport; reproduction methods	Type of disturbance[2] CC NP	SC MS	CC MS	CC BB	WF
Fragaria spp.	Birds, mammals; stored in soil (23 percent viable). Germinates on moist mineral soil in partial shade. Increases by stolons.	V	D-s	D	d	d-s
Apocynum androsaemifolium	Wind; not stored in soil. Germination requirements unknown. Increases by rhizomes.	V	v	V	V	V
Veratrum californicum	Wind?; storage ability unknown. Germination requirements unknown. Increases by rhizomes.	v	d	d-s	v-s	v-s
Castilleja miniata	Wind; storage ability unknown. Germinates on mineral soil following scarification.	v	D	D-s	d	d
Epilobium angustifolium	Wind; not stored in soil. Germinates on moist mineral soil in full sun or partial shade. Increases by rhizomes.	V	d-s	d-S	V-S	V-S
Penstemon attenuatus	No obvious transport; some storage in soil. Germinates on mineral soil in full sun.	n	D	D-S	D-s	D-s
Geranium viscosissimum	No obvious transport; stores in soil (90 percent viable). Germinates on mineral soil in full sun.	n	d	d-S	n-s	n-s
Balsamorhiza sagittata	Wind; not stored in soil. Germinates on mineral soil in full sun.	n	d	d-s	n-s	n-s
Aster perelegans	Wind; not stored in soil. Germinates on mineral soil in full sun.	n	D	D-s	n-s	n-s
Iliamna rivularis	No obvious transport; stores in soil (91 percent viable). Germinates on mineral soil in full sun, mainly following burning.	n	D	D-s	S	S
Potentilla glandulosa	No obvious transport; stores in soil (19 percent viable). Germinates on mineral soil in full sun, mainly following scarification.	n	D-s	D-S	s	s

[1]Species are arranged from climax to seral within each group.
[2]Disturbance codes: CC, NP = clearcut, no site preparation; CC, MS = clearcut, mechanical scarification; SC, MS = shelterwood cut, mechanical scarification; CC, BB = clearcut, broadcast burned; WF = stand-destroying wildfire.
[3]Response codes:
- V= vegetative increase from existing plants following tree removal (may be offset by treatment intensity)
- S= seedling response (coverage increase depends on the amount of viable seed available and may be influenced by treatment type and intensity)
- D= decrease in existing canopy coverage
- n = no appreciable change
- Upper case letters = major change worthy of management consideration
- Lower case letters = minor change in species coverage.

[4]Stored seed viabilities are from Kramer (1984).

methods of seed dissemination, vegetative increase, and germination response to specific site treatments. Potential shrub competition for a given site is best estimated by noting the kinds and amounts of existing shrubs on the site, the other species that may occur from buried or wind-borne seed, and the response of all these species to the site treatment planned (table 16). In contrast, generalized descriptions of site treatment and potential shrub responses tend to represent an average stand condition. Such predictions can be misleading for site-specific management, because few stands would fit the average; many plantations, therefore, could be lost to unexpected competition.

Duration of the competition depends on height-age interactions of tree seedlings with the shrubs and the shrub density. As noted (table 16), existing and potential shrub densities can be regulated by the kind and intensity of site treatment (guarding against the possibility of unintentionally increasing an undesirable shrub species). Growth rates for a few shrubs in the PSME/SPBE h.t. are generalized in figure 21; data are too scant for the other shrub species. If free from suppression, properly planted *Pinus ponderosa* can outgrow most shrubs germinating from seed at the time of planting. *Ribes* may substantially overtop the pine within the first few years, but a *Ribes* canopy is sparse, generally

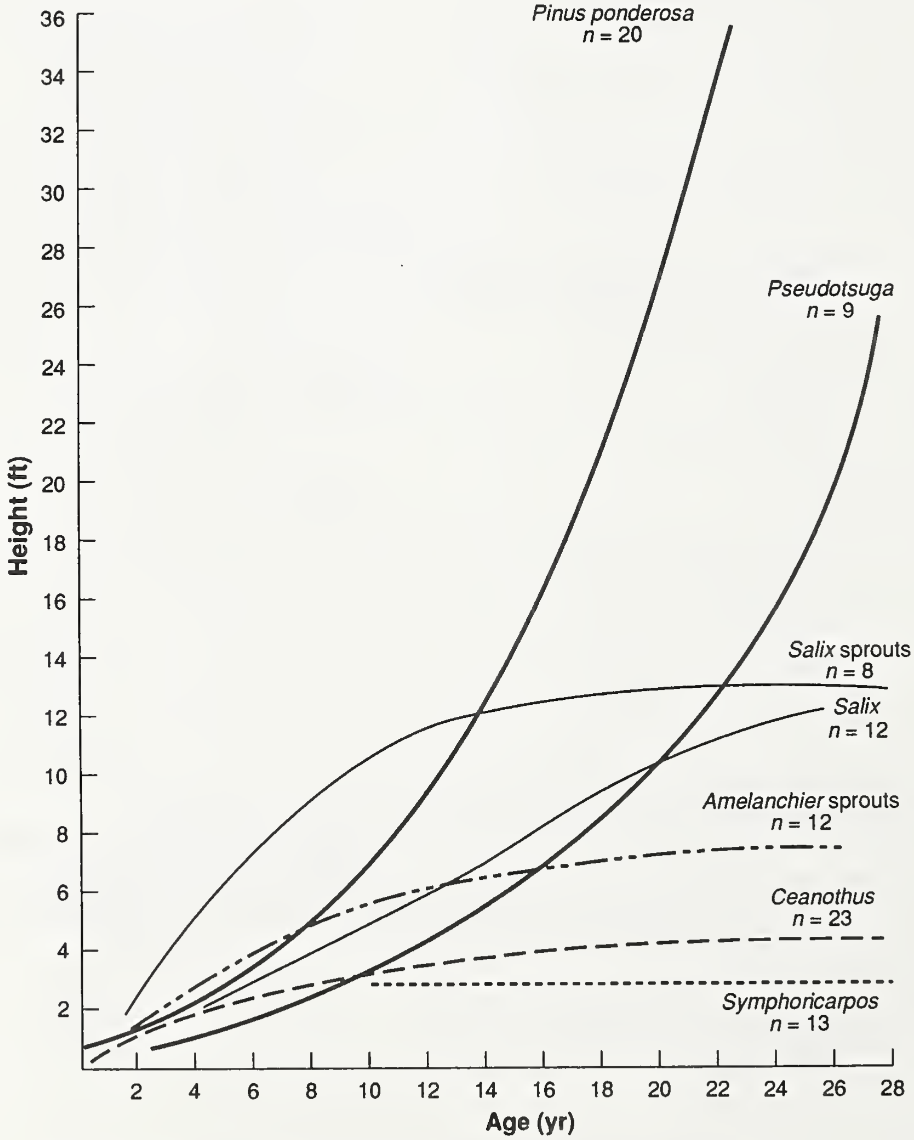

Figure 21—Height-age relationships of free-growing tree seedlings and important shrub species in the PSME/SPBE h.t., PIPO phase.

2 to 3 feet (0.6 to 0.9 meters) tall, and does not strongly suppress pine growth. Whenever pines are planted after the first growing season following disturbance, shrub seedlings such as *Ceanothus* or *Salix* may outcompete the pines.

Sprouting ability varies among shrub species and also with the size and vigor of the individual. Of the major shrubs in the PSME/SPBE h.t., *Salix* has the greatest sprouting ability. If *Salix* is abundant in unlogged stands, it can produce a dense shrub layer after the tree canopy is removed. Planted *Pinus ponderosa* seedlings would be overtopped by *Salix* sprouts within 1 to 2 years. Mechanical removal of *Salix* can entail considerable soil displacement, since these plants develop large stumps and deep root systems. Consequently, unless the shrubs can be treated with herbicides, managing for *Pseudotsuga* (which is more shade tolerant) is the only alternative for timber production.

Wildlife and Livestock

The classification sections describe some layer groups that can be achieved through prescribed site treatments and others that result mainly from uninterrupted succession. The actual layer type that may result from a particular site treatment can often be projected on a stand-by-stand basis from species composition and known successional response. When land managers consider the possible layer types that can result from alternative site treatments, they should also consider the relative forage value of these layer types for big game and livestock. Such values can be estimated from relative palatability ratings of plant species for elk (Kufeld 1973), deer (Kufeld and others 1973), cattle and sheep (USDA Forest Service 1986), and black bear (Beecham 1981). The scale of 1 to 3 in these studies was expanded to 1 to 6 to emphasize the differences in palatability values. The relative palatability value for each plant species is listed in appendixes A and B. This value was multiplied by the percentage constancy and average canopy cover (appendixes A and B) for that species in a given layer type. This step was repeated for all species in the layer type. The sum of all such products within a layer type resulted in a forage index value for that particular type. The index values were expressed as classes in order to simplify forage value assessments and to eliminate the false impression of high precision (table 17).

These index classes reflect forage potential on a relative basis but do not necessarily reflect actual use. Some index values may be biased by consistent disproportions of canopy cover to shrub volume. Likewise, actual palatability within a species can vary with plant vigor; however, other sources of variation common to this type of comparison have been reduced. For instance, the possibility of comparing differing ecotypes within a plant species is reduced by restricting the data to one habitat type. Plant species palatabilities are listed by season to accommodate seasonal forage preferences. In spite of the shortcomings inherent with these kinds of comparisons, the forage index classes can provide general guidelines for specific wildlife and range objectives as well as multifunctional planning. Range and wildlife managers who may have better species palatability ratings for a local area can easily recalculate the forage indexes from appendixes A and B; reduce the indexes to index classes (tables 17-22); and apply the results to their areas.

Forage index classes (tables 17-22) vary according to the kinds and amounts of plant species comprising the layer type. Because early seral layer types may contain a wider variety of plants than layer types in later seral stages, a larger data base is often needed to develop valid forage indexes for layer types in these early seral stages. When the same layer type occurs in different habitat types or phases, the index's variability may increase with the potential productivity of the site; more samples may be needed for the more productive sites. The index value, however, is most affected by coverages of the most palatable species and does not necessarily increase with site productivity. Ranking of species' nutritional value between habitat types and phases could refine the index values. Such considerations should be used when comparing the relative significance of forage index classes.

Deer—Shrub layer forage values for deer are mostly low to moderate throughout succession in the PSME/SPBE h.t. In the PIPO phase the highest values for deer occur in the PUTR and CEVE layer groups (table 17). In the CARU phase, the highest values occur in the CEVE layer group (table 18). In the SPBE phase (table 19), they occur in the RICE and PRVI layer groups, but these values are due mainly to unusually high coverages of a single shrub species in a few plots. It is more likely that the CEVE layer group also has the highest values throughout the SPBE phase.

Herb layer forage values are mostly low in the PSME/SPBE h.t., PIPO and SPBE phases, but are mostly moderate in the CARU phase (tables 20, 21, 22). In the PIPO phase, the highest forage values occur in the FRVE-CAGE layer type, a late midseral stage that can result from either fire or scarification. In the CARU phase, the highest values occur in the CAGE-CAGE layer type, a late seral stage. In the SPBE phase, the highest values occur in the BRCA-CAGE and GEVI-CAGE layer types. These

Table 17—Relative index classes for big-game and livestock forage preferences by shrub layer type in the PSME/SPBE h.t., PIPO phase[1]

Layer group Layer type	No. of stands	Deer SU[2]	Deer W	Elk SU	Elk W	Cattle SU	Sheep SU	Black bear SP	Black bear SU	Black bear F
Purshia tridentata										
PUTR-PUTR	3	[3]4	4	4	4	4	4	0	0	0
PUTR-CEVE	2	3	2	3	3	2	2	0	0	0
PUTR-RICE	1	3	3	2	4	2	2	1	2	2
PUTR-SASC	1	4	4	4	4	2	3	0	0	0
PUTR-AMAL	1	2	2	2	2	2	2	0	1	1
PUTR-SPBE	9	3	2	3	3	3	3	0	0	0
Ceanothus velutinus										
CEVE-CEVE	13	4	3	4	4	2	2	0	1	1
CEVE-RICE	1	3	3	3	4	2	2	1	2	1
CEVE-SASC	1	4	3	4	4	2	3	0	0	0
CEVE-PRVI	12	4	3	4	4	2	2	1	2	2
CEVE-AMAL	3	3	2	3	3	2	2	1	1	1
CEVE-SPBE	13	3	2	3	4	2	3	0	0	0
Ribes cereum										
RICE-RICE	1	1	1	1	1	1	1	0	1	1
Salix scouleriana										
SASC-SASC	1	3	3	3	3	2	3	0	0	0
SASC-PRVI	1	3	2	3	3	1	2	0	1	1
SASC-SPBE	4	3	2	3	3	2	3	0	0	0
Prunus virginiana										
PRVI-PRVI	9	3	3	3	4	2	2	1	2	3
PRVI-AMAL	6	2	2	3	3	2	2	1	2	2
PRVI-SPBE	7	3	3	4	4	3	3	1	2	2
Amelanchier alnifolia										
AMAL-AMAL	2	2	2	2	3	2	2	1	1	1
AMAL-SPBE	16	3	2	3	3	3	3	1	1	1
Spiraea betulifolia										
SPBE-SPBE	39	2	1	2	2	2	2	0	0	0

[1]Based on palatability ratings by Kufeld (1973), Kufeld and others (1973), USDA Forest Service (1986), and Beecham (1981).
[2]SP = spring (March, April, May); SU = summer (June, July, August); F = fall (September, October, November); W = winter (December, January, February).
[3]Code to index classes: 0 = 0-50; 1 = 51-150; 2 = 151-250 (low); 3 = 251-350; 4 = 351-450; 5 = 451-550 (moderate); 6 = 551-650; 7 = 651-750; 8 = 751-850 (high).

two layer types generally result from scarification without burning.

Elk—In the shrub layer, forage values for elk are mostly low to moderate. However, in the CARU phase (table 18), high values occur in the CEVE-SASC layer type. In the SPBE phase (table 19), a high value occurs in the RICE-SYOR layer type, but this is due to unusually high coverage of one species in one plot. Generally the highest forage values for elk occur in early seral stages that support high coverages of *Purshia*, *Ceanothus*, or *Salix*. These species usually establish best following burning or in the case of *Purshia*, scarification.

Herb layer forage values for elk are mostly low to moderate throughout the PSME/SPBE h.t. However, in the CARU phase values are mostly moderate and occasionally high. In the PIPO phase (table 20), the highest values occur in the FRVE-CAGE layer type. This is due to high coverages of *Fragaria* and *Carex* that have moderate to high palatabilities. In the CARU phase (table 21), the highest values occurred in the CAGE-CAGE layer type due to high coverages of *Carex geyeri*, a highly palatable species. The highest values in the SPBE phase (table 22), occurred in the BRCA-CAGE and GEVI-CAGE layer types that resulted mainly from scarification.

Table 18—Relative index classes for big-game and livestock forage preferences by shrub layer type in the PSME/SPBE h.t., CARU phase[1]

Layer group / Layer type	No. of stands	Deer SU[2]	Deer W	Elk SU	Elk W	Cattle SU	Sheep SU	Black bear SP	Black bear SU	Black bear F
Artemisia tridentata										
ARTR-ARTR	2	[3]3	3	3	4	2	3	0	0	0
Ceanothus velutinus										
CEVE-CEVE	2	4	3	4	4	2	2	0	0	0
CEVE-RICE	1	4	4	5	5	2	3	1	2	2
CEVE-SASC	1	6	5	6	6	2	4	0	1	1
CEVE-SPBE	2	2	2	2	2	1	2	0	1	1
Ribes cereum										
RICE-RICE	1	1	1	1	1	0	1	0	1	1
RICE-SPBE	2	2	2	2	2	1	2	0	1	1
Salix scouleriana										
SASC-SPBE	1	2	2	2	2	1	2	0	1	1
Prunus virginiana										
PRVI-SPBE	1	3	3	4	4	2	4	1	2	2
Symphoricarpos oreophilus										
SYOR-SYOR	1	2	1	1	2	1	2	1	1	1
SYOR-SPBE	4	2	1	2	3	1	2	0	1	1
Spiraea betulifolia										
SPBE-SPBE	14	1	1	1	1	1	1	0	0	0

[1]Based on palatability ratings by Kufeld (1973), Kufeld and others (1973), USDA Forest Service (1986), and Beecham (1981).
[2]SP = spring (March, April, May); SU = summer (June, July, August); F = fall (September, October, November); W = winter (December, January, February).
[3]Code to index classes: 0 = 0-50; 1 = 51-150; 2 = 151-250 (low); 3 = 251-350; 4 = 351-450; 5 = 451-550 (moderate); 6 = 551-650; 7 = 651-750; 8 = 751-850 (high).

Table 19—Relative index classes for big-game and livestock forage preferences by shrub layer type in the PSME/SPBE h.t., SPBE phase[1]

Layer group / Layer type	No. of stands	Deer SU[2]	Deer W	Elk SU	Elk W	Cattle SU	Sheep SU	Black bear SP	Black bear SU	Black bear F
Ceanothus velutinus										
CEVE-SPBE	2	[3]4	3	4	4	2	3	0	1	1
Ribes cereum										
RICE-SYOR	1	5	5	4	6	3	6	2	3	3
RICE-SPBE	1	2	2	2	3	1	2	0	1	1
Prunus virginiana										
PRVI-PRVI	1	2	2	3	3	1	2	1	2	2
PRVI-SYOR	1	3	2	3	3	2	3	1	2	2
PRVI-SPBE	3	5	4	5	5	3	5	1	2	2
Symphoricarpos oreophilus										
SYOR-SYOR	1	3	2	2	3	1	2	1	1	1
SYOR-SPBE	4	3	2	2	3	1	3	0	1	1
Spiraea betulifolia										
SPBE-SPBE	6	2	1	2	2	2	2	0	0	0

[1]Based on palatability ratings by Kufeld (1973), Kufeld and others (1973), USDA Forest Service (1986), and Beecham (1981).
[2]SP = spring (March, April, May); SU = summer (June, July, August); F = fall (September, October, November); W = winter (December, January, February).
[3]Code to index classes: 0 = 0-50; 1 = 51-150; 2 = 151-250 (low); 3 = 251-350; 4 = 351-450; 5 = 451-550 (moderate); 6 = 551-650; 7 = 651-750; 8 = 751-850 (high).

Table 20—Relative index classes for big-game and livestock forage preferences by herb layer type in the PSME/SPBE h.t., PIPO phase[1]

Layer group Layer type	No. of stands	Deer SU[2]	Deer W	Elk SU	Elk W	Cattle SU	Sheep SU	Black bear SP	Black bear SU	Black bear F
Annuals										
ANN.-ANN.	4	[3]1	0	1	0	1	1	1	1	0
ANN.-BRCA	2	2	1	3	2	3	2	0	0	0
ANN.-ILRI	1	1	0	2	0	1	2	1	1	0
ANN.-GEVI	1	2	1	2	2	2	2	0	0	0
ANN.-APAN	1	2	1	2	1	2	2	1	1	0
ANN.-CAGE	3	2	1	2	1	2	2	2	1	1
ANN.-CARU	3	1	1	2	1	1	2	1	1	0
Bromus carinatus										
BRCA-BRCA	4	1	1	1	1	1	1	0	0	0
BRCA-POGL	1	2	1	3	2	2	2	0	0	0
BRCA-CAGE	3	2	1	2	2	2	2	1	1	0
Potentilla glandulosa										
POGL-POGL	3	3	2	3	2	2	3	1	1	0
POGL-CAGE	4	2	2	3	2	3	2	2	1	1
POGL-CARU	2	1	1	2	1	1	1	1	1	0
Iliamna rivularis										
ILRI-ILRI	2	2	0	3	0	2	3	0	0	0
Geranium viscosissimum										
GEVI-GEVI	3	1	1	2	1	1	1	2	1	1
GEVI-APAN	4	2	1	2	1	1	2	0	0	0
GEVI-CAGE	9	2	2	3	2	3	2	2	1	1
GEVI-CARU	3	2	1	3	1	2	2	1	1	0
Apocynum androsaemifolium										
APAN-APAN	6	1	0	1	0	1	1	0	0	0
APAN-CAGE	5	2	1	2	2	2	2	1	1	0
APAN-CARU	6	2	2	3	2	3	3	2	2	1
Fragaria vesca										
FRVE-FRVE	2	2	1	2	2	1	2	1	2	1
FRVE-CAGE	3	4	3	5	4	4	4	3	3	1
FRVE-CARU	2	2	2	2	2	2	2	2	2	1
Carex geyeri										
CAGE-CAGE	24	1	1	2	2	2	1	1	1	0
CAGE-CARU	11	2	1	3	2	2	2	2	1	1
Calamagrostis rubescens										
CARU-CARU	27	1	2	3	2	2	2	2	1	1

[1]Based on palatability ratings by Kufeld (1973), Kufeld and others (1973), USDA Forest Service (1986), and Beecham (1981).

[2]SP = spring (March, April, May); SU = summer (June, July, August); F = fall (September, October, November); W = winter (December, January, February).

[3]Code to index classes:

0 = 0-50	1 = 51-150	2 = 151-250 (low)
3 = 251-350	4 = 351-450	5 = 451-550 (moderate)
6 = 551-650	7 = 651-750	8 = 751-850 (high).

Cattle—Forage values in the shrub layer are generally low to moderate in the PSME/SPBE h.t. and are consistently low in the CARU phase (table 18). The highest value occurs in the PUTR-PUTR layer type of the PIPO phase (table 17). This is largely due to the palatability and coverage of *Purshia,* which responds well to scarification and full sunlight.

Herb layer forage values are mostly low to occasionally moderate in the PIPO and SPBE phases and moderate in the CARU phase (tables 20, 21, 22). The highest values occurred where *Carex geyeri* or *Calamagrostis* had the greatest coverages. Both of these graminoids are highly palatable to cattle (appendix B-1).

Table 21—Relative index classes for big-game and livestock forage preferences by herb layer type in the PSME/SPBE h.t., CARU phase[1]

Layer group Layer type	No. of stands	Deer SU[2]	Deer W	Elk SU	Elk W	Cattle SU	Sheep SU	Black bear SP	Black bear SU	Black bear F
Annuals										
ANN.-CAGE	1	[3]3	3	5	3	4	4	4	2	1
Potentilla glandulosa										
POGL-CARU	2	3	3	5	3	4	4	3	2	1
Geranium viscosissimum										
GEVI-CARU	2	2	2	4	2	3	3	2	2	1
Fragaria vesca										
FRVE-CARU	2	3	3	5	3	4	4	3	3	1
Carex geyeri										
CAGE-CAGE	3	4	3	6	4	5	4	5	3	2
CAGE-CARU	7	2	2	4	3	4	3	3	2	1
Calamagrostis rubescens										
CARU-CARU	13	2	3	4	3	4	3	4	3	1

[1]Based on palatability ratings by Kufeld (1973), Kufeld and others (1973), USDA Forest Service (1986), and Beecham (1981).
[2]SP = spring (March, April, May); SU = summer (June, July, August); F = fall (September, October, November); W = winter (December, January, February).
[3]Code to index classes: 0 = 0-50, 1 = 51-150, 2 = 151-250 (low), 3 = 251-350, 4 = 351-450, 5 = 451-550 (moderate), 6 = 551-650, 7 = 651-750, 8 = 751-850 (high).

Table 22—Relative index classes for big-game and livestock forage preferences by herb layer type in the PSME/SPBE h.t., SPBE phase[1]

Layer group Layer type	No. of stands	Deer SU[2]	Deer W	Elk SU	Elk W	Cattle SU	Sheep SU	Black bear SP	Black bear SU	Black bear F
Annuals										
ANN.-ANN.	1	[3]2	0	2	0	2	2	0	0	0
Bromus carinatus										
BRCA-ILRI	1	1	1	2	1	2	2	0	0	0
BRCA-GEVI	1	1	1	1	2	1	1	0	0	0
BRCA-CAGE	1	3	2	4	3	4	3	2	2	1
Geranium viscosissimum										
GEVI-GEVI	2	1	1	1	1	1	1	0	0	0
GEVI-CAGE	1	3	3	4	3	4	4	2	1	1
Carex geyeri										
CAGE-CAGE	10	1	1	2	1	2	2	1	1	0

[1]Based on palatability ratings by Kufeld (1973), Kufeld and others (1973), USDA Forest Service (1986), and Beecham (1981).
[2]SP = spring (March, April, May); SU = summer (June, July, August); F = fall (September, October, November); W = winter (December, January, February).
[3]Code to index classes: 0 = 0-50, 1 = 51-150, 2 = 151-250 (low), 3 = 251-350, 4 = 351-450, 5 = 451-550 (moderate), 6 = 551-650, 7 = 651-750, 8 = 751-850 (high).

Sheep—Shrub forage values for sheep are mostly low to moderate but are occasionally high in the SPBE phase (tables 17, 18, 19). For many layer types, however, the forage value for sheep is one and occasionally two classes higher than it is for cattle. This suggests that the shrub resource would be better allocated to sheep than to cattle.

Herb layer forage values are low and occasionally moderate in the PIPO and SPBE phases and moderate in the CARU phase (tables 20, 21, 22). Forage values for sheep are similar to those for cattle in the same layer type and do not vary by more than one forage class.

Black Bear—Most shrub layers in the PSME/SPBE h.t. have little or no forage value for black bears. The PRVI-PRVI layer type is an exception when it has high coverages of *Prunus,* such as in the warmer and more productive PIPO phase. Shrub layer types having high coverages of *Ribes* may also have above-average forage values. However, all of these shrub layers must receive enough sunlight to induce flowering and fruiting to achieve these higher values.

Most herb layers in the PSME/SPBE h.t. have little or no forage value for bears. However, in the CARU phase, many herb layers have moderate value (table 21). Generally the higher values are due to high coverages of *Carex* or *Calamagrostis,* which are used by the bears in early spring. In late spring high coverages of *Fragaria* provide valuable forage for bears wherever the *Fragaria* is able to flower and fruit.

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APPENDIX A-1: PALATABILITY RATINGS, CONSTANCY, AND AVERAGE PERCENT CANOPY COVER OF SHRUB LAYER SPECIES BY LAYER TYPE IN THE PSME/SPBE H.T., PIPO PHASE

		Palatability ratings[1]								
		Deer		Elk		Cattle	Sheep	Black bear		
Codes	Species	Summer	Winter	Summer	Winter	Summer	Summer	Spring	Summer	Fall
102	*Acer glabrum*	4	6	6	6	4	4	0	0	0
105	*Amelanchier alnifolia*	4	4	6	6	4	6	2	6	6
150	*Artemisia tridentata*	2	4	2	4	2	2	0	0	0
203	*Berberis repens*	2	4	2	4	2	4	2	2	2
198	*Ceanothus sanguineus*	6	4	6	6	2	2	0	0	0
107	*Ceanothus velutinus*	6	4	6	6	2	2	0	0	0
108	*Chrysothamnus nauseosus*	2	4	4	4	2	2	0	0	0
115	*Lonicera utahensis*	2	4	6	4	2	2	2	4	4
119	*Philadelphus lewisii*	2	2	2	6	2	4	0	0	
122	*Physocarpus malvaceus*	4	2	4	2	2	4	0	0	0
123	*Prunus emarginata*	4	4	6	4	2	2	2	4	6
124	*Prunus virginiana*	4	4	4	6	2	2	2	4	6
125	*Purshia tridentata*	6	6	0	6	6	6	0	0	0
128	*Ribes cereum*	4	6	2	6	2	2	2	6	4
131	*Ribes viscosissimum*	4	6	6	6	2	4	2	6	4
133	*Rosa gymnocarpa*	2	2	6	4	0	0	0	0	0
161	*Rosa nutkana*	6	4	6	4	2	4	0	0	0
134	*Rosa woodsii*	6	6	6	4	2	4	0	0	0
136	*Rubus parviflorus*	4	2	6	2	2	4	2	4	2
137	*Salix scouleriana*	6	6	0	6	2	4	0	0	0
164	*Sambucus cerulea*	0	0	6	6	4	4	2	2	2
140	*Sorbus scopulina*	6	4	6	4	2	4	2	2	6
142	*Spiraea betulifolia*	4	2	0	4	2	4	0	0	0
162	*Spiraea pyramidata*	4	2	0	4	2	4	0	0	0
143	*Symphoricarpos albus*	4	2	6	6	2	4	2	2	2
163	*Symphoricarpos oreophilus*	4	2	2	4	2	4	2	2	2

[1]Palatability ratings (0-6) are from Kufeld and others (1973), Kufeld (1973), USDA Forest Service (1986), and Beecham (1981). Seasons are: spring (March, April, May); summer (June, July, August); fall (September, October, November); winter (December, January, February).

(con.)

APPENDIX A-1 (Con.)

SHRUB LAYER GROUP		*Purshia tridentata*					
Shrub layer type		PUTR -PUTR	PUTR -CEVE	PUTR -RICE	PUTR -SASC	PUTR -AMAL	PUTR -SPBE
Number of stands		3	2	1	1	1	9
Codes	Species	Constancy[1] (percent canopy cover)					
102	*Acer glabrum*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
105	*Amelanchier alnifolia*	10(2.2)	10(1.8)	10(0.5)	10(3.0)	10(3.0)	7(5.3)
150	*Artemisia tridentata*	0(0.0)	0(0.0)	10(15.0)	0(0.0)	0(0.0)	2(15.0)
203	*Berberis repens*	3(0.0)	0(0.0)	10(0.5)	0(0.0)	10(0.5)	0(0.0)
198	*Ceanothus sanguineus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
107	*Ceanothus velutinus*	7(15.0)	10(26.3)	0(0.0)	10(3.0)	10(0.5)	4(8.4)
108	*Chrysothamnus nauseosus*	0(0.0)	5(0.5)	10(0.5)	10(0.5)	0(0.0)	1(0.5)
115	*Lonicera utahensis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
119	*Philadelphus lewisii*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
122	*Physocarpus malvaceus*	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	1(0.5)
123	*Prunus emarginata*	0(0.0)	0(0.0)	10(0.5)	0(0.0)	10(0.5)	1(0.5)
124	*Prunus virginiana*	3(15.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	6(1.5)
125	*Purshia tridentata*	10(45.8)	10(15.0)	0(0.0)	10(15.0)	10(15.0)	8(21.4)
128	*Ribes cereum*	3(0.5)	0(0.0)	10(37.5)	10(0.5)	0(0.0)	4(1.8)
131	*Ribes viscosissimum*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
133	*Rosa gymnocarpa*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
161	*Rosa nutkana*	3(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	2(7.8)
134	*Rosa woodsii*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
136	*Rubus parviflorus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
137	*Salix scouleriana*	3(0.5)	0(0.0)	0(0.0)	10(37.5)	0(0.0)	7(3.8)
164	*Sambucus cerulea*	0(0.0)	0(0.0)	10(3.0)	0(0.0)	0(0.0)	1(0.5)
140	*Sorbus scopulina*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
142	*Spiraea betulifolia*	10(11.0)	10(15.0)	10(15.0)	0(0.0)	10(15.0)	10(32.8)
162	*Spiraea pyramidata*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
143	*Symphoricarpos albus*	3(0.5)	0(0.0)	10(0.5)	0(0.0)	10(0.5)	1(3.0)
163	*Symphoricarpos oreophilus*	3(0.5)	5(0.5)	10(3.0)	10(3.0)	10(15.0)	8(1.6)
Years since disturbance							
average		26	—	—	—	—	21
range		17-42	33-45	8	21	17	8-39

[1]Constancy values: + = >0-5%, 1 = >5-15%, 2 = >15-25%, 3 = >25-35%, 4 = >35-45%, 5 = >45-55%, 6 = >55-65%, 7 = >65-75%, 8 = >75-85%, 9 = >85-95%, 10 = >95-100%.

(con.)

APPENDIX A-1 (Con.)

SHRUB LAYER GROUP		*Ceanothus velutinus*						*Ribes cereum*	*Salix scouleriana*		
Shrub layer type		CEVE -CEVE	CEVE -RICE	CEVE -SASC	CEVE -PRVI	CEVE -AMAL	CEVE -SPBE	RICE -RICE	SASC -SASC	SASC -PRVI	SASC -SPBE
Number of stands		13	1	1	12	3	13	1	1	1	4
Codes	Species	Constancy[1] (percent canopy cover)									
102	*Acer glabrum*	2(3.0)	0(0.0)	0(0.0)	2(1.8)	0(0.0)	1(0.5)	0(0.0)	10(3.0)	0(0.0)	3(3.0)
105	*Amelanchier alnifolia*	6(5.4)	10(3.0)	10(3.0)	8(6.4)	10(11.0)	6(2.9)	10(0.5)	10(0.5)	10(3.0)	8(7.0)
150	*Artemisia tridentata*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
203	*Berberis repens*	8(7.3)	10(3.0)	0(0.0)	9(2.7)	7(1.8)	6(0.5)	0(0.0)	10(0.5)	0(0.0)	5(0.5)
198	*Ceanothus sanguineus*	0(0.0)	0(0.0)	0(0.0)	1(15.0)	0(0.0)	0) 0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
107	*Ceanothus velutinus*	10(40.0)	10(15.0)	10(15.0)	9(19.1)	10(15.0)	10(20.2)	10(3.0)	10(3.0)	10(3.0)	3(0.5)
108	*Chrysothamnus nauseosus*	0(0.0)	10(0.5)	0(0.0)	1(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)
115	*Lonicera utahensis*	2(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(3.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
119	*Philadelphus lewisii*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
122	*Physocarpus malvaceus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	2(0.5)	0(0.0)	10(3.0)	10(0.5)	3(0.5)
123	*Prunus emarginata*	5(3.0)	0(0.0)	0(0.0)	10(18.5)	7(0.5)	3(1.1)	0(0.0)	0(0.0)	10(15.0)	0(0.0)
124	*Prunus virginiana*	4(4.9)	10(3.0)	0(0.0)	8(13.2)	7(1.8)	2(19.0)	0(0.0)	10(0.5)	0(0.0)	0(0.0)
125	*Purshia tridentata*	1(0.5)	0(0.0)	0(0.0)	1(0.5)	0(0.0)	4(1.5)	0(0.0)	0(0.0)	0(0.0)	3(0.5)
128	*Ribes cereum*	5(3.8)	10(15.0)	0(0.0)	3(2.2)	0(0.0)	2(0.5)	10(15.0)	0(0.0)	0(0.0)	3(0.5)
131	*Ribes viscosissimum*	3(7.8)	10(0.5)	0(0.0)	3(6.2)	7(0.5)	2(0.5)	0(0.0)	10(0.5)	10(0.5)	0(0.0)
133	*Rosa gymnocarpa*	1(0.5)	0(0.0)	0(0.0)	0(0.0)	7(0.5)	0(0.0)	0(0.0)	0(0.0)	10(0.5)	0(0.0)
161	*Rosa nutkana*	0(0.0)	10(15.0)	0(0.0)	3(5.3)	0(0.0)	1(0.5)	0(0.0)	0(0.0)	0(0.0)	8(0.5)
134	*Rosa woodsii*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
136	*Rubus parviflorus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(15.0)	0(0.0)	0(0.0)	0(0.0)	10(3.0)	0(0.0)
137	*Salix scouleriana*	4(4.9)	10(0.5)	10(37.5)	4(5.4)	7(1.8)	8(4.5)	0(0.0)	10(37.5)	10(15.0)	10(15.0)
164	*Sambucus cerulea*	2(0.5)	0(0.0)	0(0.0)	3(1.1)	3(0.5)	0(0.0)	0(0.0)	0(0.0)	10(0.5)	0(0.0)
140	*Sorbus scopulina*	4(0.5)	0(0.0)	0(0.0)	2(1.8)	7(0.5)	1(3.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)
142	*Spiraea betulifolia*	9(8.8)	10(0.5)	10(15.0)	9(14.6)	7(15.0)	9(40.2)	10(3.0)	10(15.0)	10(15.0)	8(38.3)
162	*Spiraea pyramidata*	0(0.0)	0(0.0)	0(0.0)	1(15.0)	3(15.0)	1(37.5)	0(0.0)	0(0.0)	0(0.0)	3(37.5)
143	*Symphoricarpos albus*	0(0.0)	0(0.0)	0(0.0)	1(3.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(1.8)
163	*Symphoricarpos oreophilus*	9(2.5)	10(15.0)	0(0.0)	10(7.8)	10(11.0)	5(5.4)	10(3.0)	10(0.0)	0(0.0)	5(7.8)
Years since disturbance											
	average	17	—	—	19	17	18	—	—	—	35
	range	10-30	11	14	10-42	11-21	6-41	12	18	18	18-47

[1]Constancy values: + = >0-5%; 1 = >5-15%; 2 = >15-25%; 3 = >25-35%; 4 = >35-45%; 5 = >45-55%; 6 = >55-65%; 7 = >65-75%; 8 = >75-85%; 9 = >85-95%; 10 = >95-100%.

(con.)

APPENDIX A-1 (Con.)

SHRUB LAYER GROUP		*Prunus virginiana*			*Amelanchier alnifolia*		*Spiraea betulifolia*
Shrub layer type		**PRVI -PRVI**	**PRVI -AMAL**	**PRVI -SPBE**	**AMAL -AMAL**	**AMAL -SPBE**	**SPBE -SPBE**
Number of stands		9	6	7	2	16	39
Codes	**Species**	*Constancy[1] (percent canopy cover)*					
102	*Acer glabrum*	4(1.1)	7(1.1)	1(3.0)	0(0.0)	3(1.0)	2(1.8)
105	*Amelanchier alnifolia*	6(9.7)	10(15.0)	7(14.7)	10(7.8)	9(14.6)	8(1.5)
150	*Artemisia tridentata*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.5)
203	*Berberis repens*	9(8.2)	10(1.8)	7(1.0)	10(7.8)	9(3.8)	6(1.0)
198	*Ceanothus sanguineus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(3.0)
107	*Ceanothus velutinus*	4(2.4)	5(3.0)	6(1.1)	10(1.8)	8(1.8)	5(1.6)
108	*Chrysothamnus nauseosus*	0(0.0)	2(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
115	*Lonicera utahensis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	2(1.3)
119	*Philadelphus lewisii*	1(15.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(3.0)
122	*Physocarpus malvaceus*	1(0.5)	3(1.8)	0(0.0)	5(3.0)	1(0.5)	2(1.2)
123	*Prunus emarginata*	9(14.3)	5(10.2)	9(12.6)	10(1.8)	3(0.5)	1(0.5)
124	*Prunus virginiana*	10(27.3)	8(15.0)	7(26.6)	5(0.5)	3(1.0)	3(1.6)
125	*Purshia tridentata*	1(0.5)	0(0.0)	1(0.5)	5(3.0)	1(0.5)	2(0.9)
128	*Ribes cereum*	1(3.0)	7(0.5)	1(0.5)	5(0.5)	1(1.8)	0(0.0)
131	*Ribes viscosissimum*	1(0.5)	3(0.5)	0(0.0)	0(0.0)	2(0.5)	1(0.5)
133	*Rosa gymnocarpa*	3(0.5)	0(0.0)	3(0.5)	0(0.0)	1(0.5)	1(1.0)
161	*Rosa nutkana*	1(0.5)	0(0.0)	1(0.5)	5(0.5)	2(1.3)	1(1.0)
134	*Rosa woodsii*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)	1(0.5)
136	*Rubus parviflorus*	1(0.5)	0(0.0)	1(3.0)	0(0.0)	0(0.0)	0(0.5)
137	*Salix scouleriana*	2(1.8)	2(0.5)	3(3.0)	5(3.0)	3(2.5)	4(1.7)
164	*Sambucus cerulea*	1(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(1.1)
140	*Sorbus scopulina*	1(0.5)	2(0.5)	0(0.0)	0(0.0)	3(0.5)	1(0.5)
142	*Spiraea betulifolia*	8(13.3)	10(11.0)	10(41.1)	10(9.0)	10(49.8)	10(32.4)
162	*Spiraea pyramidata*	1(15.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(26.3)
143	*Symphoricarpos albus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)	2(2.1)
163	*Symphoricarpos oreophilus*	9(5.7)	10(10.6)	10(1.9)	10(26.3)	9(8.9)	6(1.3)
Years since disturbance							
	average	12	30	38	—	31	43
	range	6-18	5-75	4-85	6-17	4-84	5-100

[1]Constancy values: + = >0-5% 1 = >5-15% 2 = >15-25% 3 = >25-35% 4 = >35-45% 5 = >45-55% 6 = >55-65% 7 = >65-75% 8 = >75-85% 9 = >85-95% 10 = >95-100%.

APPENDIX A-2: PALATABILITY RATINGS, CONSTANCY, AND AVERAGE PERCENT CANOPY COVER OF SHRUB LAYER SPECIES BY LAYER TYPE IN THE PSME/SPBE H.T., CARU PHASE

		Palatability ratings[1]								
		Deer		Elk		Cattle	Sheep	Black bear		
Codes	Species	Summer	Winter	Summer	Winter	Summer	Summer	Spring	Summer	Fall
102	*Acer glabrum*	4	6	6	6	4	4	0	0	0
105	*Amelanchier alnifolia*	4	4	6	6	4	6	2	6	6
150	*Artemisia tridentata*	2	4	2	4	2	2	0	0	0
203	*Berberis repens*	2	4	2	4	2	4	2	2	2
198	*Ceanothus sanguineus*	6	4	6	6	2	2	0	0	0
107	*Ceanothus velutinus*	6	4	6	6	2	2	0	0	0
108	*Chrysothamnus nauseosus*	2	4	4	4	2	2	0	0	0
115	*Lonicera utahensis*	2	4	6	4	2	2	2	4	4
118	*Pachistima myrsinites*	4	6	4	4	2	4	0	0	0
119	*Philadelphus lewisii*	2	2	2	6	2	4	0	0	0
122	*Physocarpus malvaceus*	4	2	4	2	2	4	0	0	0
123	*Prunus emarginata*	4	4	6	4	2	2	2	4	6
124	*Prunus virginiana*	4	4	4	6	2	2	2	4	6
125	*Purshia tridentata*	6	6	6	6	6	6	0	0	0
128	*Ribes cereum*	4	6	2	6	2	2	2	6	4
131	*Ribes viscosissimum*	4	6	6	6	2	4	2	6	4
133	*Rosa gymnocarpa*	6	4	6	4	2	4	0	0	0
161	*Rosa nutkana*	6	4	6	4	2	4	0	0	0
134	*Rosa woodsii*	6	6	6	6	2	4	0	0	0
136	*Rubus parviflorus*	4	2	6	2	2	4	2	4	2
137	*Salix scouleriana*	6	6	6	6	2	4	0	0	0
138	*Sambucus racemosa*	6	2	6	6	4	4	2	2	2
139	*Shepherdia canadensis*	2	2	2	4	2	4	2	6	4
140	*Sorbus scopulina*	6	4	6	4	2	4	2	2	6
142	*Spiraea betulifolia*	4	2	4	4	2	4	0	0	0
162	*Spiraea pyramidata*	4	2	4	4	2	4	0	0	0
143	*Symphoricarpos albus*	4	2	6	6	2	4	2	2	2
163	*Symphoricarpos oreophilus*	4	2	2	4	2	4	2	2	2

[1]Palatability ratings (0-6) are from Kufeld and others (1973), Kufeld (1973), USDA Forest Service (1986), and Beecham (1981). Seasons are: spring (March, April, May); summer (June, July, August); fall (September, October, November); winter (December, January, February).

(con.)

APPENDIX A-2 (Con.)

SHRUB LAYER GROUP		*Artemisia tridentata*	*Ceanothus velutinus*			
Shrub layer type		ARTR -ARTR	CEVE -CEVE	CEVE -RICE	CEVE -SASC	CEVE -SPBE
Number of stands		2	2	1	1	2
Codes	Species	Constancy[1] (percent canopy cover)				
102	*Acer glabrum*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(0.5)
105	*Amelanchier alnifolia*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	10(0.5)
150	*Artemisia tridentata*	10(62.5)	5(0.5)	10(0.5)	0(0.0)	0(0.0)
203	*Berberis repens*	10(0.5)	5(0.5)	0(0.0)	0(0.0)	10(0.5)
198	*Ceanothus sanguineus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
107	*Ceanothus velutinus*	0(0.0)	10(50.0)	10(15.0)	10(37.5)	5(15.0)
108	*Chrysothamnus nauseosus*	5(0.5)	0(0.0)	10(0.5)	0(0.0)	0(0.0)
115	*Lonicera utahensis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	10(0.5)
118	*Pachistima myrsinites*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(15.0)
119	*Philadelphus lewisii*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
122	*Physocarpus malvaceus*	0(0.0)	5(0.5)	0(0.0)	10(0.5)	0(0.0)
123	*Prunus emarginata*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
124	*Prunus virginiana*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
125	*Purshia tridentata*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
128	*Ribes cereum*	10(1.8)	5(15.0)	10(0.5)	10(3.0)	0(0.0)
131	*Ribes viscosissimum*	10(0.5)	5(0.5)	10(37.5)	10(15.0)	5(0.5)
133	*Rosa gymnocarpa*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
161	*Rosa nutkana*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
134	*Rosa woodsii*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
136	*Rubus parviflorus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
137	*Salix scouleriana*	10(0.5)	5(0.5)	10(3.0)	10(37.5)	5(0.5)
138	*Sambucus racemosa*	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)
139	*Shepherdia canadensis*	0(0.0)	0(0.0)	10(0.5)	10(3.0)	5(15.0)
140	*Sorbus scopulina*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
142	*Spiraea betulifolia*	10(37.5)	10(20.3)	10(37.5)	10(15.0)	10(26.3)
162	*Spiraea pyramidata*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
143	*Symphoricarpos albus*	0(0.0)	5(0.5)	0(0.0)	0(0.0)	10(1.8)
163	*Symphoricarpos oreophilus*	10(3.0)	5(0.5)	10(0.5)	10(0.5)	0(0.0)
Years since disturbance						
	average	—	—	—	—	—
	range	22-27	16	16	21	22

[1]Constancy values: + = >0-5%, 1 = >5-15%, 2 = >15-25%, 3 = >25-35%, 4 = >35-45%, 5 = >45-55%, 6 = >55-65%, 7 = >65-75%, 8 = >75-85%, 9 = >85-95%, 10 = >95-100%.

(con.)

APPENDIX A-2 (Con.)

SHRUB LAYER GROUP		*Ribes cereum*		*Salix scouleriana*	*Prunus virginiana*	*Symphoricarpos oreophilus*		*Spiraea betulifolia*
Shrub layer type		RICE -RICE	RICE -SPBE	SASC -SPBE	PRVI -SPBE	SYOR -SYOR	SYOR -SPBE	SPBE -SPBE
Number of stands		1	2	1	1	1	4	14
Codes	Species	Constancy[1] (percent canopy cover)						
102	*Acer glabrum*	0(0.0)	0(0.0)	0(0.0)	10(3.0)	0(0.0)	3(3.0)	3(1.1)
105	*Amelanchier alnifolia*	0(0.0)	0(0.0)	10(0.5)	10(15.0)	0(0.0)	10(4.8)	1(3.0)
150	*Artemisia tridentata*	10(3.0)	5(0.5)	0(0.0)	0(0.0)	10(0.5)	0(0.0)	0(0.0)
203	*Berberis repens*	0(0.0)	0(0.0)	0(0.0)	10(15.0)	0(0.0)	8(2.2)	8(5.1)
198	*Ceanothus sanguineus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
107	*Ceanothus velutinus*	0(0.0)	10(1.8)	0(0.0)	0(0.0)	10(0.5)	0(0.0)	1(0.5)
108	*Chrysothamnus nauseosus*	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
115	*Lonicera utahensis*	0(0.0)	0(0.0)	10(15.0)	10(0.5)	0(0.0)	0(0.0)	2(1.3)
118	*Pachistima myrsinites*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(3.0)	3(10.4)
119	*Philadelphus lewisii*	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
122	*Physocarpus malvaceus*	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)
123	*Prunus emarginata*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
124	*Prunus virginiana*	0(0.0)	0(0.0)	0(0.0)	10(15.0)	0(0.0)	5(3.0)	1(3.0)
125	*Purshia tridentata*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
128	*Ribes cereum*	10(15.0)	10(1.8)	0(0.0)	0(0.0)	10(0.5)	5(0.0)	1(0.5)
131	*Ribes viscosissimum*	0(0.0)	10(15.0)	0(0.0)	0(0.0)	10(0.5)	5(0.5)	1(0.5)
133	*Rosa gymnocarpa*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
161	*Rosa nutkana*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
134	*Rosa woodsii*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
136	*Rubus parviflorus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
137	*Salix scouleriana*	10(0.5)	10(3.0)	10(15.0)	0(0.0)	0(0.5)	3(3.0)	0(0.0)
138	*Sambucus racemosa*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
139	*Shepherdia canadensis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)
140	*Sorbus scopulina*	0(0.0)	0(0.0)	10(0.5)	0(0.0)	0(0.0)	5(0.5)	1(1.8)
142	*Spiraea betulifolia*	10(3.0)	10(15.0)	10(15.0)	10(37.5)	10(15.0)	10(38.1)	10(21.4)
162	*Spiraea pyramidata*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
143	*Symphoricarpos albus*	0(0.0)	0(0.0)	0(0.0)	10(3.0)	0(0.0)	0(0.0)	1(3.0)
163	*Symphoricarpos oreophilus*	10(3.0)	10(1.8)	0(0.0)	0(0.0)	10(37.5)	10(12.0)	6(2.1)
Years since disturbance								
	average	—	—	—	—	—	—	95
	range	17	19-21	18	—	13	80	50-170

[1]Constancy values: + = >0-5% 2 = >15-25% 4 = >35-45% 6 = >55-65% 8 = >75-85% 10 = >95-100%.
1 = >5-15% 3 = >25-35% 5 = >45-55% 7 = >65-75% 9 = >85-95%

APPENDIX A-3: PALATABILITY RATINGS, CONSTANCY, AND AVERAGE PERCENT CANOPY COVER OF SHRUB LAYER SPECIES BY LAYER TYPE IN THE PSME/SPBE H.T., SPBE PHASE

		Palatability ratings[1]								
		Deer		Elk		Cattle	Sheep	Black bear		
Codes	Species	Summer	Winter	Summer	Winter	Summer	Summer	Spring	Summer	Fall
102	*Acer glabrum*	4	6	6	6	4	4	0	0	0
105	*Amelanchier alnifolia*	4	4	6	6	4	6	2	6	6
150	*Artemisia tridentata*	2	4	2	4	2	2	0	0	0
203	*Berberis repens*	2	4	2	4	2	4	2	2	2
198	*Ceanothus sanguineus*	6	4	6	6	2	2	0	0	0
107	*Ceanothus velutinus*	6	4	6	6	2	2	0	0	0
108	*Chrysothamnus nauseosus*	2	4	4	4	2	2	0	0	0
115	*Lonicera utahensis*	2	4	6	4	2	2	2	4	4
118	*Pachistima myrsinites*	4	6	4	4	2	4	0	0	0
119	*Philadelphus lewisii*	2	2	2	6	2	4	0	0	0
122	*Physocarpus malvaceus*	4	2	4	2	2	4	0	0	0
123	*Prunus emarginata*	4	4	6	4	2	2	2	4	6
124	*Prunus virginiana*	4	4	4	6	2	2	2	4	6
125	*Purshia tridentata*	6	6	6	6	6	6	0	0	0
128	*Ribes cereum*	4	6	2	6	2	2	2	6	4
131	*Ribes viscosissimum*	4	6	6	6	2	4	2	6	4
133	*Rosa gymnocarpa*	6	4	6	4	2	4	0	0	0
161	*Rosa nutkana*	6	4	6	4	2	4	0	0	0
134	*Rosa woodsii*	6	6	6	6	2	4	0	0	0
136	*Rubus parviflorus*	4	2	6	2	2	4	2	4	2
137	*Salix scouleriana*	6	6	6	6	2	4	0	0	0
138	*Sambucus racemosa*	6	2	6	6	4	4	2	2	2
139	*Shepherdia canadensis*	2	2	2	4	2	4	2	6	4
140	*Sorbus scopulina*	6	4	6	4	2	4	2	2	6
142	*Spiraea betulifolia*	4	2	4	4	2	4	0	0	0
162	*Spiraea pyramidata*	4	2	4	4	2	4	0	0	0
143	*Symphoricarpos albus*	4	2	6	6	2	4	2	2	2
163	*Symphoricarpos oreophilus*	4	2	2	4	2	4	2	2	2

[1]Palatability ratings (0-6) are from Kufeld and others (1973), Kufeld (1973), USDA Forest Service (1986), and Beecham (1981). Seasons are: spring (March, April, May); summer (June, July, August); fall (September, October, November); winter (December, January, February).

(con.)

APPENDIX A-3 (Con.)

SHRUB LAYER GROUP		*Ceanothus velutinus*	*Ribes cereum*		*Prunus virginiana*			*Symphoricarpos oreophilus*		*Spiraea betulifolia*
Shrub layer type		CEVE -SPBE	RICE -SYOR	RICE -SPBE	PRVI -PRVI	PRVI -SYOR	PRVI -SPBE	SYOR -SYOR	SYOR -SPBE	SPBE -SPBE
Number of stands		2	1	1	1	1	3	1	4	6
Codes	Species	Constancy[1] (percent canopy cover)								
102	*Acer glabrum*	0(0.0)	10(0.5)	0(0.0)	10(3.0)	0(0.0)	10(7.0)	10(3.0)	0(0.0)	5(2.2)
105	*Amelanchier alnifolia*	5(0.5)	0(0.0)	0(0.0)	10(0.5)	10(15.0)	10(15.0)	10(3.0)	10(2.4)	3(1.8)
150	*Artemisia tridentata*	5(0.5)	0(0.0)	10(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
203	*Berberis repens*	5(0.5)	10(62.5)	10(0.5)	10(3.0)	10(3.0)	7(3.0)	0(0.0)	8(7.0)	5(1.3)
198	*Ceanothus sanguineus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
107	*Ceanothus velutinus*	10(19.0)	0(0.0)	10(3.0)	0(0.0)	10(3.0)	0(0.0)	10(0.5)	0(0.0)	2(0.5)
108	*Chrysothamnus nauseosus*	5(3.0)	0(0.0)	10(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
115	*Lonicera utahensis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
118	*Pachistima myrsinites*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	7(44.0)	0(0.0)	3(3.0)	0(0.0)
119	*Philadelphus lewisii*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
122	*Physocarpus malvaceus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
123	*Prunus emarginata*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	10(15.0)	10(15.0)	0(0.0)	0(0.0)	0(0.0)
124	*Prunus virginiana*	0(0.0)	0(0.0)	0(0.0)	10(37.5)	10(0.5)	10(15.0)	0(0.0)	5(1.8)	0(0.0)
125	*Purshia tridentata*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)
128	*Ribes cereum*	10(7.8)	10(15.0)	10(15.0)	0(0.0)	10(3.0)	7(0.5)	10(3.0)	0(0.0)	5(0.5)
131	*Ribes viscosissimum*	10(1.8)	0(0.0)	0(0.0)	10(0.5)	0(0.0)	0(0.0)	10(0.5)	3(0.5)	5(0.5)
133	*Rosa gymnocarpa*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
161	*Rosa nutkana*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
134	*Rosa woodsii*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
136	*Rubus parviflorus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
137	*Salix scouleriana*	10(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
138	*Sambucus racemosa*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
139	*Shepherdia canadensis*	5(15.0)	10(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(1.3)
140	*Sorbus scopulina*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	10(0.5)	0(0.0)	0(0.0)	3(0.5)	2(0.5)
142	*Spiraea betulifolia*	10(50.0)	10(37.5)	10(37.5)	10(15.0)	10(15.0)	10(45.8)	10(15.0)	8(30.0)	10(54.2)
162	*Spiraea pyramidata*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(85.0)	0(0.0)
143	*Symphoricarpos albus*	0(0.0)	0(0.0)	0(0.0)	10(3.0)	0(0.0)	3(3.0)	0(0.0)	0(0.0)	2(0.5)
163	*Symphoricarpos oreophilus*	5(3.0)	10(37.5)	10(3.0)	0(0.0)	10(15.0)	7(1.8)	10(37.5)	10(12.0)	8(2.0)
Years since disturbance										
	average	—	—	—	—	—	—	—	—	80
	range	18-24	—	10	11	20	50	18	80-190	5-107

[1]Constancy values: + = >0-5%; 1 = >5-15%; 2 = >15-25%; 3 = >25-35%; 4 = >35-45%; 5 = >45-55%; 6 = >55-65%; 7 = >65-75%; 8 = >75-85%; 9 = >85-95%; 10 = >95-100%.

APPENDIX B-1: PALATABILITY RATINGS, CONSTANCY, AND AVERAGE PERCENT CANOPY COVER OF HERB LAYER SPECIES BY LAYER TYPE IN THE PSME/SPBE H.T., PIPO PHASE

		Palatability ratings[1]								
		Deer		Elk		Cattle	Sheep	Black bear		
Codes	Species	Summer	Winter	Summer	Winter	Summer	Summer	Spring	Summer	Fall
	Perennial graminoids									
301	*Agropyron spicatum*	2	4	4	6	4	2	0	0	0
303	*Bromus carinatus*	4	2	6	4	6	4	0	0	0
282	*Bromus inermis*	4	4	6	4	6	4	0	0	0
307	*Calamagrostis rubescens*	2	4	6	4	6	4	6	4	2
309	*Carex geyeri*	4	4	6	6	6	4	6	4	2
311	*Carex rossii*	2	2	4	2	2	4	6	4	2
316	*Elymus glaucus*	2	0	6	4	3	2	0	0	0
317	*Festuca occidentalis*	4	4	4	6	6	6	0	0	0
331	*Poa nervosa*	4	2	6	4	4	4	0	0	0
	Perennial forbs									
401	*Achillea millefolium*	2	2	2	2	2	4	0	0	0
566	*Agastache urticifolia*	4	0	4	0	4	6	0	0	0
414	*Antennaria microphylla*	4	2	2	2	2	4	0	0	0
413	*Antennaria racemosa*	4	2	2	2	2	4	0	0	0
415	*Apocynum androsaemifolium*	2	0	2	0	2	2	0	0	0
420	*Arenaria macrophylla*	2	0	2	0	2	4	0	0	0
421	*Arnica cordifolia*	4	0	4	0	2	4	0	0	0
426	*Aster conspicuus*	2	2	4	2	4	4	0	0	0
586	*Aster perelegans*	4	2	4	2	4	4	0	0	0
430	*Astragalus miser*	0	0	2	0	2	2	0	0	0
431	*Balsamhoriza sagittata*	4	4	2	4	4	6	0	0	0
438	*Castilleja miniata*	2	0	2	0	2	2	0	0	0
442	*Chimaphila umbellata*	0	0	0	0	0	0	0	0	0
459	*Epilobium angustifolium*	4	2	6	2	2	4	0	0	0
615	*Frasera montana*	2	2	4	2	4	4	0	0	0
465	*Fragaria vesca*	4	4	2	4	2	4	2	6	2
466	*Fragaria virginiana*	2	2	2	4	2	4	2	6	2
473	*Geranium viscosissimum*	4	2	6	2	2	4	0	0	0
483	*Hieracium albertinum*	4	2	4	2	6	6	0	0	0
484	*Hieracium albiflorum*	4	2	4	2	6	6	0	0	0
833	*Iliamna rivularis*	4	0	6	0	4	6	0	0	0
635	*Kelloggia galioides*	2	0	2	0	2	4	0	0	0
495	*Lithospermum ruderale*	4	2	4	2	2	4	0	0	0
499	*Lupinus* spp.	4	2	2	4	2	4	0	0	0

[1]Palatability ratings (0-6) are from Kufeld and others (1973), Kufeld (1973), USDA Forest Service (1986), and Beecham (1981). Seasons are: spring (March, April, May); summer (June, July, August); fall (September, October, November); winter (December, January, February).

(con.)

APPENDIX B-1: (Con.)

		Palatability ratings[1]								
		Deer		Elk		Cattle	Sheep	Black bear		
Codes	Species	Summer	Winter	Summer	Winter	Summer	Summer	Spring	Summer	Fall
	Perennial forbs									
[2]#46	*Osmorhiza* spp.	2	0	0	0	2	4	6	4	2
506	*Osmorhiza occidentalis*	6	0	6	0	4	6	6	4	2
656	*Paeonia brownii*	2	0	2	0	2	2	0	0	0
#23	*Penstemon* spp.	4	2	2	2	2	4	0	0	0
658	*Penstemon attenuatus*	4	2	2	2	2	4	0	0	0
661	*Penstemon payettensis*	4	2	2	2	2	4	0	0	0
514	*Penstemon wilcoxii*	4	2	2	2	2	4	0	0	0
522	*Potentilla glandulosa*	4	2	4	2	2	4	0	0	0
542	*Smilacina racemosa*	6	2	4	2	2	4	6	4	2
#47	*Thalictrum* spp.	4	2	6	2	2	4	0	0	0
[3]*09	*Tragopogon dubius*	4	2	4	4	4	4	0	0	0
551	*Valeriana sitchensis*	4	0	6	0	2	4	0	0	0
691	*Veratrum californicum*	4	2	4	2	4	4	2	2	2
695	*Viola purpurea*	2	0	2	0	2	4	0	0	0
	Annuals, biennials, and short-lived perennials									
*11	*Bromus tectorum*	2	4	2	4	2	2	0	0	0
595	*Chaenactis douglasii*	2	4	2	2	2	2	0	0	0
*12	*Cirsium vulgare*	2	2	2	2	2	2	0	0	0
912	*Clarkia rhomboidea*	2	0	2	0	2	2	0	0	0
#56	*Collomia* spp.	2	0	2	0	2	2	0	0	0
902	*Collinsia parviflora*	2	0	2	0	2	2	0	0	0
914	*Cryptantha affinis*	0	0	0	0	0	2	0	0	0
904	*Epilobium* spp.	2	0	2	0	2	2	0	0	0
905	*Galium aparine*	2	0	2	0	2	2	6	4	2
919	*Galium bifolium*	2	0	2	0	2	2	0	0	0
930	*Gayophytum* spp.	2	0	2	0	2	2	0	0	0
886	*Gnaphalium microcephalum*	2	0	2	0	2	4	0	0	0
*02	*Lactuca serriola*	4	2	4	2	6	6	0	0	0
920	*Nemophila breviflora*	2	0	2	0	2	2	0	0	0
918	*Nemophila parviflora*	2	0	2	0	2	2	0	0	0
#51	*Phacelia* spp.	4	2	4	2	2	4	0	0	0
*16	*Verbascum thapsus*	2	2	2	2	2	2	0	0	0

[1]Palatability ratings (0-6) are from Kufeld and others (1973), Kufeld (1973), USDA Forest Service (1986), and Beecham (1981). Seasons are: spring (March, April, May); summer (June, July, August); fall (September, October, November); winter (December, January, February).
[2]# = genus listing.
[3]* = nonnative species.

(con.)

APPENDIX B-1 (Con.)

HERB LAYER GROUP		Annuals							*Bromus carinatus*		
Herb layer type		ANN.-ANN.	ANN.-BRCA	ANN.-ILRI	ANN.-GEVI	ANN.-APAN	ANN.-CAGE	ANN.-CARU	BRCA-BRCA	BRCA-POGL	BRCA-CAGE
Number of stands		4	1	1	2	1	3	3	4	1	3
Codes	Species	Constancy[1] (percent canopy cover)									
	Perennial graminoids										
301	*Agropyron spicatum*	0(0.0)	0(0.0)	0(0.0)	10(1.8)	0(0.0)	0(0.0)	3(0.5)	5(15.0)	0(0.0)	0(0.0)
303	*Bromus carinatus*	5(0.5)	10(37.5)	10(3.0)	0(0.0)	0(0.0)	7(3.0)	3(0.5)	5(15.0)	10(15.0)	7(15.0)
282	*Bromus inermis*	3(0.5)	0(0.0)	0(0.0)	5(15.0)	10(0.5)	3(0.5)	0(0.0)	3(0.5)	0(0.0)	3(15.0)
307	*Calamagrostis rubescens*	3(3.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	10(0.5)	10(11.0)	5(3.0)	0(0.0)	3(0.5)
309	*Carex geyeri*	8(2.2)	10(0.3)	10(0.5)	5(3.0)	10(15.0)	10(22.5)	7(1.8)	10(0.5)	10(3.0)	10(11.0)
311	*Carex rossii*	3(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	7(0.5)	3(0.5)	8(0.5)	10(0.5)	7 (0.5)
316	*Elymus glaucus*	3(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)
317	*Festuca occidentalis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)	0(0.0)
331	*Poa nervosa*	0(0.0)	10(0.5)	0(0.0)	5(0.5)	10(3.0)	0(0.0)	3(0.5)	3(0.5)	0(0.0)	3(3.0)
	Perennial forbs										
401	*Achillea millefolium*	5(0.5)	10(0.5)	0(0.0)	10(0.5)	0(0.0)	7(0.5)	0(0.0)	8(0.5)	10(0.5)	10(0.5)
566	*Agastache urticifolia*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)	0(0.0)
414	*Antennaria microphylla*	3(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)	0(0.0)	3(0.5)
413	*Antennaria racemosa*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
415	*Apocynum androsaemifolium*	3(0.5)	0(0.0)	0(0.0)	10(0.5)	10(15.0)	3(0.5)	7(0.5)	3(0.5)	0(0.0)	7(1.8)
420	*Arenaria macrophylla*	3(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	3(0.5)	3(0.5)	10(0.5)	0(0.0)
421	*Arnica cordifolia*	3(0.5)	0(0.0)	0(0.0)	0(0.0)	10(3.0)	3(0.5)	3(37.5)	3(3.0)	0(0.0)	0(0.0)
426	*Aster conspicuus*	3(0.5)	0(0.0)	0(0.0)	5(3.0)	10(3.0)	3(3.0)	3(0.5)	5(3.0)	0(0.0)	7(7.8)
586	*Aster perelegans*	0(0.0)	0(0.0)	0(0.0)	5(0.5)	10(0.5)	0(0.0)	0(0.0)	0(0.0)	10(0.5)	0(0.0)
430	*Astragalus miser*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
431	*Balsamhoriza sagittata*	5(1.8)	0(0.0)	10(0.5)	10(1.8)	10(0.5)	0(0.0)	0(0.0)	3(3.0)	10(3.0)	3(0.5)
438	*Castilleja miniata*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	3(0.5)	0(0.0)	0(0.0)
442	*Chimaphila umbellata*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)	0(0.0)
459	*Epilobium angustifolium*	3(0.5)	10(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)
615	*Frasera montana*	3(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
465	*Fragaria vesca*	3(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	3(0.5)	0(0.0)	0(0.0)	7(3.0)
466	*Fragaria virginiana*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
473	*Geranium viscosissimum*	0(0.0)	0(0.0)	0(0.0)	5(15.0)	10(0.5)	7(1.8)	3(0.5)	0(0.0)	10(15.0)	3(0.5)
483	*Hieracium albertinum*	3(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)	10(0.5)	3(0.5)
484	*Hieracium albiflorum*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	3(0.5)	0(0.0)	0(0.0)
833	*Iliamna rivularis*	5(0.5)	0(0.0)	10(15.0)	0(0.0)	10(0.5)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)
635	*Kelloggia galioides*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	7(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
495	*Lithospermum ruderale*	3(0.5)	10(0.5)	10(0.5)	10(0.5)	0(0.0)	7(0.5)	0(0.0)	3(0.5)	0(0.0)	0(0.0)
499	*Lupinus* spp.	0(0.0)	0(0.0)	0(0.0)	5(3.0)	0(0.0)	0(0.0)	3(0.5)	3(3.0)	0(0.0)	3(15.0)

[1]Constancy values: + = >0-5%; 1 = >5-15%; 2 = >15-25%; 3 = >25-35%; 4 = >35-45%; 5 = >45-55%; 6 = >55-65%; 7 = >65-75%; 8 = >75-85%; 9 = >85-95%; 10 = >95-100%.

(con.)

APPENDIX B-1 (Con.)

HERB LAYER GROUP		Annuals							*Bromus carinatus*		
Herb layer type		ANN. -ANN.	ANN. -BRCA	ANN. -ILRI	ANN. -GEVI	ANN. -APAN	ANN. -CAGE	ANN. -CARU	BRCA -BRCA	BRCA -POGL	BRCA -CAGE
Number of stands		4	1	1	2	1	3	3	4	1	3
Codes	Species	Constancy[1] (percent canopy cover)									
	Perennial graminoids										
[2]#46	*Osmorhiza* spp.	5(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(15.0)	0(0.0)	0(0.0)	0(0.0)
506	*Osmorhiza occidentalis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
656	*Paeonia brownii*	0(0.0)	0(0.0)	0(0.0)	5(0.5)	10(0.5)	3(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
#23	*Penstemon* spp.	0(0.0)	0(0.0)	0(0 0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
658	*Penstemon attenuatus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	3(0.5)	0(0.0)	10(0.5)	0(0.0)
661	*Penstemon payettensis*	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)
514	*Penstemon wilcoxii*	5(0.5)	0(0.0)	0(0.0)	5(0.5)	10(0.5)	3(0.5)	7(0.5)	3(0.5)	0(0.0)	10(1.3)
522	*Potentilla glandulosa*	3(0.5)	0(0.0)	0(0.0)	5(3.0)	0(0.0)	0(0.0)	3(0.5)	3(0.5)	10(15.0)	10(0.5)
542	*Smilacina racemosa*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	3(0.5)	10(0.5)	3(0.5)
#47	*Thalictrum* spp.	3(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(15.0)	3(3.0)	0(0.0)	0(0.0)	0(0.0)
[3]*09	*Tragopogon dubius*	5(0.5)	10(0.5)	10(0.5)	10(0.5)	0(0.0)	10(0.5)	3(0.5)	5(0.5)	10(0.5)	10(0.5)
551	*Valeriana sitchensis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
691	*Veratrum californicum*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	10(3.0)	0(0.0)
695	*Viola purpurea*	0(0.0)	0(0.0)	10(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	10(0.5)	0(0.0)
	Annuals, biennials, and short-lived perennials										
*11	*Bromus tectorum*	3(0.5)	10(0.5)	0(0.0)	10(15.0)	0(0.0)	3(3.0)	3(15.0)	0(0.0)	0(0.0)	7(0.5)
595	*Chaenactis douglasii*	3(0.5)	0(0.0)	0(0.0)	10(0.5)	0(0.0)	7(0.5)	3(0.5)	5(0.5)	0(0.0)	3(0.5)
*12	*Cirsium vulgare*	5(1.8)	10(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	7(1.8)	5(0.5)	0(0.0)	3(0.5)
912	*Clarkia rhomboidea*	5(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	3(0.5)	0(0.0)	0(0.0)
#56	*Collomia* spp.	5(0.5)	0(0.0)	10(0.5)	5(0.5)	10(15.0)	3(3.0)	0(0.0)	3(0.5)	0(0.0)	3(0.5)
902	*Collinsia parviflora*	8(0.5)	10(0.5)	0(0.0)	10(0.5)	10(3.0)	3(0.5)	3(3.0)	3(0.5)	10(0.5)	3(3.0)
914	*Cryptantha affinis*	5(0.5)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)
904	*Epilobium* spp.	5(20.3)	10(15.0)	0(0.0)	0(0.0)	10(0.5)	3(3.0)	7(7.8)	3(0.5)	0(0.0)	3(0.5)
905	*Galium aparine*	8(13.7)	0(0.0)	10(15.0)	10(0.5)	0(0.0)	7(9.0)	3(0.5)	5(0.5)	0(0.0)	3(0.5)
919	*Galium bifolium*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
930	*Gayophytum* spp.	5(9.0)	10(0.5)	10(3.0)	5(0.5)	0(0.0)	10(11.0)	7(0.5)	3(0.5)	0(0.0)	0(0.0)
886	*Gnaphalium microcephalum*	5(0.5)	0(0.0)	10(0.5)	0(0.0)	0(0.0)	3(0.5)	3(0.5)	0(0.0)	0(0.0)	3(0.5)
*02	*Lactuca serriola*	5(0.5)	10(0.5)	0(0.0)	10(3.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)	3(0.5)
920	*Nemophila breviflora*	3(15.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
918	*Nemophila parviflora*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
#51	*Phacelia* spp.	5(0.5)	10(0.5)	0(0.0)	10(0.5)	0(0.0)	10(0.5)	10(0.5)	5(0.5)	10(0.5)	3(0.5)
*16	*Verbascum thapsus*	3(0.5)	10(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	7(0.5)
999	Bare soil	10(38.8)	10(30.0)	10(37.5)	10(35.0)	10(15.0)	10(26.0)	10(30.0)	8(22.5)	10(37.5)	10(15.5)
Years since disturbance											
	average	10	—	—	—	—	18	8	14	—	8
	range	2-17	10	11	19	4	17-19	2-18	10-20	9	5-10

[1]Constancy values: + = >0-5%; 1 = >5-15%; 2 = >15-25%; 3 = >25-35%; 4 = >35-45%; 5 = >45-55%; 6 = >55-65%; 7 = >65-75%; 8 = >75-85%; 9 = >85-95%; 10 = >95-100%.

[2]# = genus listing.

[3]* = nonnative species.

(con.)

APPENDIX B-1 (Con.)

HERB LAYER GROUP		*Potentilla glandulosa*			*Iliamna rivularis*	*Geranium viscosissimum*			
Herb layer type		POGL -POGL	POGL -CAGE	POGL -CARU	ILRI -ILRI	GEVI -GEVI	GEVI -APAN	GEVI -CAGE	GEVI -CARU
Number of stands		3	4	2	2	3	4	9	3
Codes	Species	Constancy[1] (percent canopy cover)							
	Perennial graminoids								
301	*Agropyron spicatum*	0(0.0)	0(0.0)	0(0 0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)
303	*Bromus carinatus*	7(0.5)	8(1.3)	0(0.0)	5(0.5)	7(0.5)	10(0.5)	7(1.3)	0(0.0)
282	*Bromus inermis*	3(0.5)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)	0(0.0)
307	*Calamagrostis rubescens*	7(1.8)	5(9.0)	5(15.0)	5(0.5)	7(7.8)	3(0.5)	6(8.9)	3(37.5)
309	*Carex geyeri*	10(11.0)	10(26.3)	5(3.0)	10(1.8)	10(2.2)	10(6.0)	10(23.0)	7(1.8)
311	*Carex rossii*	7(0.5)	10(4.1)	10(7.8)	5(0.5)	7(1.8)	8(0.5)	4(0.5)	3(0.5)
316	*Elymus glaucus*	0(0.0)	0(0.0)	5(0.5)	0(0.0)	3(0.5)	0(0.0)	0(0.0)	0(0.0)
317	*Festuca occidentalis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
331	*Poa nervosa*	3(0.5)	8(1.3)	5(0.5)	0(0.0)	3(0.5)	3(0.5)	3(1.3)	3(0.5)
	Perennial forbs								
401	*Achillea millefolium*	10(0.5)	3(0.5)	0(0.0)	0(0.0)	10(0.5)	5(0.5)	3(0.5)	0(0.0)
566	*Agastache urticifolia*	3(0.5)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
414	*Antennaria microphylla*	3(0.5)	3(0.5)	5(0.5)	0(0.0)	7(0.5)	3(0.5)	1(0.5)	0(0.0)
413	*Antennaria racemosa*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)	3(0.5)
415	*Apocynum androsaemifolium*	7(9.0)	3(0.5)	5(0.5)	0(0.0)	3(3.0)	10(20.6)	0(0.0)	3(3.0)
420	*Arenaria macrophylla*	3(0.5)	0(0.0)	5(0.5)	5(0.5)	0(0.0)	3(0.5)	1(0.5)	3(0.5)
421	*Arnica cordifolia*	3(0.5)	0(0.0)	0(0.0)	5(0.5)	3(0.5)	0(0.0)	2(0.5)	10(18.5)
426	*Aster conspicuus*	3(3.0)	0(0.0)	5(3.0)	5(3.0)	3(0.5)	0(0.0)	6(6.8)	3(3.0)
586	*Aster perelegans*	3(0.5)	3(0.5)	0(0.0)	0(0.0)	3(0.5)	3(0.5)	4(4.1)	3(0.5)
430	*Astragalus miser*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
431	*Balsamhoriza sagittata*	3(0.5)	8(1.3)	5(0.5)	0(0.0)	3(0.5)	5(9.0)	4(4.8)	0(0.0)
438	*Castilleja miniata*	3(0.5)	3(0.5)	5(0.5)	0(0.0)	7(19.0)	0(0.0)	3(1.3)	3(15.0)
442	*Chimaphila umbellata*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	7(1.8)
459	*Epilobium angustifolium*	7(0.5)	8(0.5)	5(0.5)	0(0.0)	0(0.0)	8(0.5)	2(0.5)	7(9.0)
615	*Frasera montana*	0(0.0)	5(0.5)	0(0.0)	0(0.0)	3(0.5)	3(0.5)	4(2.4)	0(0.0)
465	*Fragaria vesca*	3(15.0)	5(0.5)	0(0.0)	5(0.5)	7(0.5)	5(0.5)	0(0.0)	3(3.0)
466	*Fragaria virginiana*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	2(1.8)	3(0.5)
473	*Geranium viscosissimum*	10(7.0)	5(9.0)	0(0.0)	5(0.5)	7(15.0)	8(15.0)	7(15.0)	7(9.0)
483	*Hieracium albertinum*	7(0.5)	5(0.5)	5(0.5)	0(0.0)	3(0.5)	5(0.5)	7(0.9)	7(0.5)
484	*Hieracium albiflorum*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)
833	*Iliamna rivularis*	7(0.5)	5(1.8)	0(0.0)	10(38.8)	0(0.0)	3(0.5)	4(0.5)	0(0.0)
635	*Kelloggia galioides*	10(0.5)	3(0.5)	0(0.0)	0(0.0)	3(0.5)	8(0.5)	2(0.5)	0(0.0)
495	*Lithospermum ruderale*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)
499	*Lupinus* spp.	3(0.5)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	1(0.5)	3(0.5)

[1]Constancy values: + = >0-5%; 1 = >5-15%; 2 = >15-25%; 3 = >25-35%; 4 = >35-45%; 5 = >45-55%; 6 = >55-65%; 7 = >65-75%; 8 = >75-85%; 9 = >85-95%; 10 = >95-100%.

(con.)

APPENDIX B-1 (Con.)

HERB LAYER GROUP		Potentilla glandulosa			Iliamna rivularis	Geranium viscosissimum			
Herb layer type		POGL -POGL	POGL -CAGE	POGL -CARU	ILRI -ILRI	GEVI -GEVI	GEVI -APAN	GEVI -CAGE	GEVI -CARU
Number of stands		3	4	2	2	3	4	9	3
Codes	Species	Constancy[1] (percent canopy cover)							
	Perennial graminoids								
[2]#46	*Osmorhiza* spp.	0(0.0)	0(0.0)	0(0.0)	5(0.5)	3(0.5)	3(0.5)	2(1.8)	0(0.0)
506	*Osmorhiza occidentalis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
656	*Paeonia brownii*	7(0.5)	3(0.5)	0(0.0)	0(0.0)	7(0.5)	5(0.5)	2(0.5)	0(0.0)
#23	*Penstemon* spp.	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
658	*Penstemon attenuatus*	0(0.0)	3(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(5.3)	0(0.0)
661	*Penstemon payettensis*	3(0.5)	3(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
514	*Penstemon wilcoxii*	7(1.8)	8(0.5)	5(0.5)	10(7.8)	3(0.5)	8(1.3)	6(1.0)	0(0.0)
522	*Potentilla glandulosa*	10(37.5)	8(15.0)	5(15.0)	5(3.0)	10(2.2)	10(0.5)	6(1.0)	3(3.0)
542	*Smilacina racemosa*	7(0.5)	3(0.5)	5(0.5)	10(0.5)	3(0.5)	5(0.5)	2(0.5)	3(15.0)
#47	*Thalictrum* spp.	10(1.3)	0(0.0)	5(15.0)	0(0.0)	3(0.5)	3(0.5)	3(2.2)	3(0.5)
[3]*09	*Tragopogon dubius*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	1(0.5)	3(0.5)
551	*Valeriana sitchensis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	1(0.5)	3(0.5)
691	*Veratrum californicum*	3(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
695	*Viola purpurea*	7(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)
	Annuals, biennials, and short-lived perennials								
*11	*Bromus tectorum*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	3(3.0)	1(0.5)	0(0.0)
595	*Chaenactis douglasii*	0(0.0)	5(0.5)	0(0.0)	5(0.5)	3(0.5)	0(0.0)	0(0.0)	0(0.0)
*12	*Cirsium vulgare*	0(0.0)	0(0.0)	0(0.0)	5(0.5)	3(0.5)	0(0.0)	0(0.0)	0(0.0)
912	*Clarkia rhomboidea*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)
#56	*Collomia* spp.	3(0.5)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	3(0.5)	1(0.5)	0(0.0)
902	*Collinsia parviflora*	3(0.5)	3(0.5)	5(0.5)	10(0.5)	3(0.5)	5(0.5)	0(0.0)	0(0.0)
914	*Cryptantha affinis*	3(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)	0(0.0)
904	*Epilobium* spp.	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	3(0.5)	0(0.0)
905	*Galium aparine*	3(0.5)	0(0.0)	0(0.0)	5(0.5)	3(0.5)	0(0.0)	0(0.0)	0(0.0)
919	*Galium bifolium*	3(0.5)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	2(1.8)	0(0.0)
930	*Gayophytum* spp.	3(0.5)	3(0.5)	5(0.5)	5(0.5)	3(3.0)	8(1.3)	0(0.0)	0(0.0)
886	*Gnaphalium microcephalum*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	5(0.5)	2(0.5)	7(0.5)
*02	*Lactuca serriola*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)
920	*Nemophila breviflora*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
918	*Nemophila parviflora*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
#51	*Phacelia* spp.	0(0.0)	8(0.5)	0(0.0)	10(1.8)	3(0.5)	5(0.5)	2(0.5)	0(0.0)
*16	*Verbascum thapsus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	3(0.5)
999	Bare soil	10(11.0)	10(12.0)	10(9.0)	10(15.0)	10(7.0)	10(11.6)	9(9.0)	7(9.0)
Years since disturbance									
	average	12	14	—	—	13	17	19	27
	range	6-18	5-25	23-45	3-10	8-21	14-19	8-42	6-70

[1]Constancy values: + = >0-5%; 1 = >5-15%; 2 = >15-25%; 3 = >25-35%; 4 = >35-45%; 5 = >45-55%; 6 = >55-65%; 7 = >65-75%; 8 = >75-85%; 9 = >85-95%; 10 = >95-100%.
[2]# = genus listing.
[3]* = nonnative species.

(con.)

APPENDIX B-1 (Con.)

HERB LAYER GROUP		Apocynum androsaemifolium			Fragaria vesca			Carex geyeri		Calamagrostis rubescens
Herb layer type		APAN -APAN	APAN -CAGE	APAN -CARU	FRVE -FRVE	FRVE -CAGE	FRVE -CARU	CAGE -CAGE	CAGE -CARU	CARU -CARU
Number of stands		6	5	6	2	3	2	24	11	27
Codes	Species	Constancy[1] (percent canopy cover)								
	Perennial graminoids									
301	*Agropyron spicatum*	0(0.0)	0(0.0)	2(0.5)	0(0.0)	0(0.0)	0(0.0)	1(0.5)	0(0.0)	0(0.0)
303	*Bromus carinatus*	3(1.8)	6(1.3)	5(1.3)	5(0.5)	7(0.5)	10(0.5)	5(1.1)	1(0.5)	1(0.5)
282	*Bromus inermis*	2(3.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)	0(0.0)	0(0.0)
307	*Calamagrostis rubescens*	7(1.8)	8(1.8)	10(37.9)	0(0.0)	0(0.0)	10(26.3)	4(3.0)	6(28.2)	9(38.0)
309	*Carex geyeri*	10(2.6)	8(22.6)	8(1.0)	10(3.0)	10(33.5)	10(1.8)	10(19.7)	9(11.1)	9(1.9)
311	*Carex rossii*	7(1.1)	8(1.1)	2(0.5)	0(0.0)	3(0.5)	0(0.0)	3(0.5)	5(1.0)	4(0.5)
316	*Elymus glaucus*	2(0.5)	2(0.5)	2(3.0)	5(15.0)	3(3.0)	0(0.0)	1(0.5)	1(0.5)	0(0.0)
317	*Festuca occidentalis*	0(0.0)	0(0.0)	0(0.0)	5(0.5)	3(0.5)	0(0.0)	1(0.5)	2(0.5)	1(0.5)
331	*Poa nervosa*	3(0.5)	2(0.5)	3(1.8)	0(0.0)	0(0.0)	5(3.0)	4(2.2)	4(4.8)	3(0.5)
	Perennial forbs									
401	*Achillea millefolium*	3(0.5)	0(0.0)	8(1.0)	5(0.5)	3(0.5)	5(0.5)	1(0.5)	4(0.5)	3(0.5)
566	*Agastache urticifolia*	2(0.5)	0(0.0)	0(0.0)	0(0.0)	3(3.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
414	*Antennaria microphylla*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	10(0.5)	1(0.5)	2(1.0)	1(0.5)
413	*Antennaria racemosa*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	3(1.3)	1(0.5)	1(0.5)
415	*Apocynum androsaemifolium*	10(18.8)	8(15.0)	10(16.3)	5(3.0)	3(0.5)	5(0.5)	4(1.9)	5(0.5)	4(2.1)
420	*Arenaria macrophylla*	3(0.5)	4(0.5)	5(0.5)	10(1.8)	0(0.0)	0(0.0)	4(2.1)	7(2.6)	7(0.6)
421	*Arnica cordifolia*	3(1.8)	4(7.8)	5(13.7)	10(1.8)	7(19.0)	10(1.8)	4(3.9)	6(9.5)	7(8.2)
426	*Aster conspicuus*	3(1.8)	10(11.3)	2(3.0)	5(0.5)	7(20.3)	10(0.5)	4(11.1)	5(10.6)	4(1.3)
586	*Aster perelegans*	2(0.5)	0(0.0)	3(0.5)	0(0.0)	3(0.5)	0(0.0)	2(1.0)	1(0.5)	1(0.5)
430	*Astragalus miser*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
431	*Balsamhoriza sagittata*	3(0.5)	4(0.5)	5(1.3)	0(0.0)	3(0.5)	0(0.0)	3(1.7)	0(0.0)	3(0.5)
438	*Castilleja miniata*	2(0.5)	2(0.5)	0(0.0)	5(0.5)	0(0.0)	5(3.0)	3(0.9)	1(0.5)	2(0.5)
442	*Chimaphila umbellata*	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	1(5.3)	3(1.3)	2(0.5)
459	*Epilobium angustifolium*	2(0.5)	4(0.5)	2(0.5)	5(0.5)	10(0.5)	0(0.0)	3(0.5)	6(1.6)	3(1.1)
615	*Frasera montana*	0(0.0)	2(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	2(0.5)	2(0.5)	2(0.5)
465	*Fragaria vesca*	5(0.5)	2(0.5)	3(7.8)	10(26.3)	10(22.5)	10(15.0)	4(1.3)	2(0.5)	3(1.4)
466	*Fragaria virginiana*	0(0.0)	2(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(3.0)	1(3.0)	1(0.5)
473	*Geranium viscosissimum*	8(1.0)	4(3.0)	5(1.3)	10(0.5)	3(3.0)	10(0.5)	4(0.8)	5(0.5)	4(0.7)
483	*Hieracium albertinum*	3(0.5)	2(0.5)	3(0.5)	5(0.5)	0(0.0)	5(0.5)	3(0.8)	3(1.3)	4(0.7)
484	*Hieracium albiflorum*	2(0.5)	0(0.0)	5(0.5)	10(0.5)	7(0.5)	10(0.5)	3(0.8)	5(0.5)	3(0.5)
833	*Iliamna rivularis*	3(0.5)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	2(1.1)	0(0.0)	0(0.0)
635	*Kelloggia galioides*	0(0.0)	2(0.5)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	2(0.5)	1(0.5)	1(0.5)
495	*Lithospermum ruderale*	0(0.0)	4(0.5)	3(0.5)	0(0.0)	0(0.0)	0(0.0)	2(0.5)	0(0.0)	0(0.5)
499	*Lupinus* spp.	0(0.0)	0(0.0)	2(0.5)	0(0.0)	0(0.0)	5(3.0)	2(0.5)	3(13.7)	1(1.3)

[1]Constancy values: + = >0-5% 1 = >5-15% 2 = >15-25% 3 = >25-35% 4 = >35-45% 5 = >45-55% 6 = >55-65% 7 = >65-75% 8 = >75-85% 9 = >85-95% 10 = >95-100%.

(con.)

APPENDIX B-1 (Con.)

HERB LAYER GROUP		*Apocynum androsaemifolium*			*Fragaria vesca*			*Carex geyeri*		*Calamagrostis rubescens*
Herb layer type		APAN -APAN	APAN -CAGE	APAN -CARU	FRVE -FRVE	FRVE -CAGE	FRVE -CARU	CAGE -CAGE	CAGE -CARU	CARU -CARU
Number of stands		6	5	6	2	3	2	24	11	27
Codes	Species	Constancy[1] (percent canopy cover)								
	Perennial graminoids									
[2]#46	*Osmorhiza* spp.	2(0.5)	2(0.5)	7(0.5)	5(0.5)	7(0.5)	0(0.0)	1(0.5)	2(0.5)	2(0.5)
506	*Osmorhiza occidentalis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
656	*Paeonia brownii*	2(0.5)	2(0.5)	3(0.5)	5(0.5)	0(0.0)	0(0.0)	3(0.5)	3(0.5)	2(0.5)
#23	*Penstemon* spp.	2(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
658	*Penstemon attenuatus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.5)	2(1.8)	0(0.5)
661	*Penstemon payettensis*	3(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	2(0.5)	0(0.0)	0(0.0)
514	*Penstemon wilcoxii*	3(0.5)	8(0.5)	8(0.5)	10(0.5)	0(0.0)	5(0.5)	8(0.5)	3(0.5)	3(0.5)
522	*Potentilla glandulosa*	3(0.5)	4(0.5)	7(0.5)	10(0.5)	10(0.5)	10(0.5)	3(1.3)	5(0.9)	1(1.8)
542	*Smilacina racemosa*	3(0.5)	4(0.5)	2(0.5)	5(0.5)	7(0.5)	0(0.0)	4(0.8)	4(0.5)	4(0.9)
#47	*Thalictrum* spp.	5(1.3)	8(1.1)	0(0.0)	5(0.5)	10(11.0)	0(0.0)	3(2.6)	4(5.4)	1(4.8)
[3]*09	*Tragopogon dubius*	0(0.0)	0(0.0)	7(0.5)	5(0.5)	0(0.0)	10(0.5)	3(0.5)	1(0.5)	1(0.5)
551	*Valeriana sitchensis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.5)	1(0.5)	0(0.5)
691	*Veratrum californicum*	0(0.0)	2(0.5)	2(15.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)	1(0.5)
695	*Viola purpurea*	2(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
	Annuals, biennials, and short-lived perennials									
*11	*Bromus tectorum*	0(0.0)	0(0.0)	2(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
595	*Chaenactis douglasii*	3(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
*12	*Cirsium vulgare*	3(0.5)	2(0.5)	0(0.0)	5(0.5)	7(0.5)	5(0.5)	5(0.5)	0(0.0)	0(0.0)
912	*Clarkia rhomboidea*	2(0.5)	2(0.5)	2(0.5)	0(0.0)	0(0.0)	0(0.0)	2(0.5)	0(0.0)	1(0.5)
#56	*Collomia* spp.	3(0.5)	2(0.5)	7(1.1)	0(0.0)	0(0.0)	0(0.0)	1(0.5)	1(0.5)	1(0.5)
902	*Collinsia parviflora*	2(0.5)	0(0.0)	2(3.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	1(3.0)	2(0.5)
914	*Cryptantha affinis*	2(0.5)	0(0.0)	3(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.5)	0(0.0)	1(0.5)
904	*Epilobium* spp.	2(0.5)	8(0.5)	3(0.5)	0(0.0)	0(0.0)	0(0.0)	3(1.3)	1(0.5)	1(0.5)
905	*Galium aparine*	0(0.0)	2(0.5)	2(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.5)	2(0.5)	1(0.5)
919	*Galium bifolium*	0(0.0)	0(0.0)	2(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.5)
930	*Gayophytum* spp.	5(1.3)	0(0.0)	3(0.5)	0(0.0)	0(0.0)	5(0.5)	2(0.5)	1(3.0)	2(0.5)
886	*Gnaphalium microcephalum*	5(0.5)	6(0.5)	2(0.5)	5(0.5)	0(0.0)	0(0.0)	3(0.5)	1(0.5)	1(0.5)
*02	*Lactuca serriola*	0(0.0)	2(0.5)	2(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.5)	0(0.0)	0(0.0)
920	*Nemophila breviflora*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
918	*Nemophila parviflora*	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.5)
#51	*Phacelia* spp.	7(0.5)	6(0.5)	2(0.5)	5(0.5)	0(0.0)	0(0.0)	3(0.5)	1(0.5)	1(0.5)
*16	*Verbascum thapsus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	5(0.5)	0(0.5)	0(0.0)	0(0.0)
999	Bare soil	10(14.8)	10(7.3)	5(14.5)	5(0.5)	7(1.8)	10(7.8)	—	6(2.9)	5(9.3)
Years since disturbance										
	average	13	23	52	—	19	—	34	33	39
	range	4-33	5-24	13-84	25-30	11-25	15-19	10-100	6-80	8-84

[1]Constancy values: + = >0-5%; 1 = >5-15%; 2 = >15-25%; 3 = >25-35%; 4 = >35-45%; 5 = >45-55%; 6 = >55-65%; 7 = >65-75%; 8 = >75-85%; 9 = >85-95%; 10 = >95-100%.

[2]# = genus listing.

[3]* = nonnative species.

APPENDIX B-2: PALATABILITY RATINGS, CONSTANCY, AND AVERAGE PERCENT CANOPY COVER OF HERB LAYER SPECIES BY LAYER TYPE IN THE PSME/SPBE H.T., CARU PHASE

		Palatability ratings[1]								
		Deer		Elk		Cattle	Sheep	Black bear		
Codes	Species	Summer	Winter	Summer	Winter	Summer	Summer	Spring	Summer	Fall
	Perennial graminoids									
301	*Agropyron spicatum*	2	4	4	6	4	2	0	0	0
303	*Bromus carinatus*	4	2	6	4	6	4	0	0	0
282	*Bromus inermis*	4	4	6	4	6	4	0	0	0
307	*Calamagrostis rubescens*	2	4	6	4	6	4	6	4	2
309	*Carex geyeri*	4	4	6	6	6	4	6	4	2
311	*Carex rossii*	2	2	4	2	2	4	6	4	2
316	*Elymus glaucus*	2	0	6	4	3	2	0	0	0
317	*Festuca occidentalis*	4	4	4	6	6	6	0	0	0
331	*Poa nervosa*	4	2	6	4	4	4	0	0	0
	Perennial forbs									
401	*Achillea millefolium*	2	2	2	2	2	4	0	0	0
566	*Agastache urticifolia*	4	0	4	0	4	6	0	0	0
414	*Antennaria microphylla*	4	2	2	2	2	4	0	0	0
413	*Antennaria racemosa*	4	2	2	2	2	4	0	0	0
415	*Apocynum androsaemifolium*	2	0	2	0	2	2	0	0	0
420	*Arenaria macrophylla*	2	0	2	0	2	4	0	0	0
421	*Arnica cordifolia*	4	0	4	0	2	4	0	0	0
426	*Aster conspicuus*	2	2	4	2	4	4	0	0	0
586	*Aster perelegans*	4	2	4	2	4	4	0	0	0
430	*Astragalus miser*	0	0	2	0	2	2	0	0	0
431	*Balsamhoriza sagittata*	4	4	2	4	4	6	0	0	0
438	*Castilleja miniata*	2	0	2	0	2	2	0	0	0
442	*Chimaphila umbellata*	0	0	0	0	0	0	0	0	0
459	*Epilobium angustifolium*	4	2	6	2	2	4	0	0	0
615	*Frasera montana*	2	2	4	2	4	4	0	0	0
465	*Fragaria vesca*	4	4	2	4	2	4	2	6	2
466	*Fragaria virginiana*	2	2	2	4	2	4	2	6	2
473	*Geranium viscosissimum*	4	2	6	2	2	4	0	0	0
483	*Hieracium albertinum*	4	2	4	2	6	6	0	0	0
484	*Hieracium albiflorum*	4	2	4	2	6	6	0	0	0
833	*Iliamna rivularis*	4	0	6	0	4	6	0	0	0
635	*Kelloggia galioides*	2	0	2	0	2	4	0	0	0
495	*Lithospermum ruderale*	4	2	4	2	2	4	0	0	0
499	*Lupinus* spp.	4	2	2	4	2	4	0	0	0

[1]Palatability ratings (0-6) are from Kufeld and others (1973), Kufeld (1973), USDA Forest Service (1986), and Beecham (1981). Seasons are: spring (March, April, May); summer (June, July, August); fall (September, October, November); winter (December, January, February).

(con.)

APPENDIX B-2: (Con.)

		Palatability ratings[1]								
		Deer		Elk		Cattle	Sheep	Black bear		
Codes	Species	Summer	Winter	Summer	Winter	Summer	Summer	Spring	Summer	Fall
	Perennial forbs									
[2]#46	*Osmorhiza* spp.	2	0	0	0	2	4	6	4	2
506	*Osmorhiza occidentalis*	6	0	6	0	4	6	6	4	2
656	*Paeonia brownii*	2	0	2	0	2	2	0	0	0
#23	*Penstemon* spp.	4	2	2	2	2	4	0	0	0
658	*Penstemon attenuatus*	4	2	2	2	2	4	0	0	0
661	*Penstemon payettensis*	4	2	2	2	2	4	0	0	0
514	*Penstemon wilcoxii*	4	2	2	2	2	4	0	0	0
522	*Potentilla glandulosa*	4	2	4	2	2	4	0	0	0
524	*Smilacina racemosa*	6	2	4	2	2	4	6	4	2
#47	*Thalictrum* spp.	4	2	6	2	2	4	0	0	0
[3]*09	*Tragopogon dubius*	4	2	4	4	4	4	0	0	0
551	*Valeriana stichensis*	4	0	6	0	2	4	0	0	0
691	*Veratrum californicum*	4	2	4	2	4	4	2	2	2
695	*Viola purpurea*	2	0	2	0	2	4	0	0	0
	Annual, biennials, and short-lived perennials									
*11	*Bromus tectorum*	2	4	2	4	2	2	0	0	0
595	*Chaenactis douglasii*	2	4	2	2	2	2	0	0	0
*12	*Cirsium vulgare*	2	2	2	2	2	2	0	0	0
912	*Clarkia rhomboidea*	2	0	2	0	2	2	0	0	0
#56	*Collomia* spp.	2	0	2	0	2	2	0	0	0
902	*Collinsia parviflora*	2	0	2	0	2	2	0	0	0
914	*Cryptantha affinis*	0	0	0	0	0	2	0	0	0
904	*Epilobium* spp.	2	0	2	0	2	2	0	0	0
905	*Galium aparine*	2	0	2	0	2	2	6	4	2
919	*Galium bifolium*	2	0	2	0	2	2	0	0	0
930	*Gayophytum* spp.	2	0	2	0	2	2	0	0	0
886	*Gnaphalium microcephalum*	2	0	2	0	2	4	0	0	0
*02	*Lactuca serriola*	4	2	4	2	6	6	0	0	0
920	*Nemophila breviflora*	2	0	2	0	2	2	0	0	0
918	*Nemophila parviflora*	2	0	2	0	2	2	0	0	0
#51	*Phacelia* spp.	4	2	4	2	2	4	0	0	0
*16	*Verbascum thapsus*	2	2	2	2	2	2	0	0	0

[1]Palatability ratings (0-6) are from Kufeld and others (1973), Kufeld (1973), USDA Forest Service (1986), and Beecham (1981). Seasons are: spring (March, April, May); summer (June, July, August); fall (September, October, November); winter (December, January, February).
[2]# = genus listing.
[3]* = nonnative species.

(con.)

APPENDIX B-2 (Con.)

HERB LAYER GROUP		Annuals	*Potentilla glandulosa*	*Geranium viscosissimum*	*Fragaria vesca*	*Carex geyeri*		*Calamagrostis rubescens*
Herb layer type		ANN. -CAGE	POGL -CARU	GEVI -CARU	FRVE -CARU	CAGE -CAGE	CAGE -CARU	CARU -CARU
Number of stands		1	2	2	2	3	7	13
Codes	Species	Constancy[1] (percent canopy cover)						
	Perennial graminoids							
301	*Agropyron spicatum*	10(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)
303	*Bromus carinatus*	0(0.0)	5(0.5)	5(0.5)	0(0.0)	7(1.8)	3(0.5)	0(0.0)
282	*Bromus inermis*	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
307	*Calamagrostis rubescens*	10(15.0)	10(50.0)	10(37.5)	5(85.0)	10(15.0)	10(42.9)	10(60.6)
309	*Carex geyeri*	10(37.5)	5(0.5)	0(0.0)	0(0.0)	10(53.3)	7(10.2)	4(0.5)
311	*Carex rossii*	10(0.5)	5(0.5)	10(1.8)	5(0.5)	3(3.0)	3(0.5)	3(1.1)
316	*Elymus glaucus*	0(0.0)	0(0.0)	5(0.5)	5(3.0)	3(3.0)	1(0.5)	0(0.0)
317	*Festuca occidentalis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)
331	*Poa nervosa*	0(0.0)	10(1.8)	0(0.0)	0(0.0)	3(0.5)	7(4.9)	8(1.3)
	Perennial forbs							
401	*Achillea millefolium*	0(0.0)	5(0.5)	0(0.0)	10(1.8)	3(0.5)	4(0.5)	5(0.5)
566	*Agastache urticifolia*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
414	*Antennaria microphylla*	0(0.0)	10(0.5)	5(0.5)	0(0.0)	3(0.5)	7(1.0)	5(0.5)
413	*Antennaria racemosa*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	4(1.3)	4(1.5)
415	*Apocynum androsaemifolium*	0(0.0)	0(0.0)	5(0.5)	5(3.0)	0(0.0)	0(0.0)	0(0.0)
420	*Arenaria macrophylla*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)	0(0.0)
421	*Arnica cordifolia*	10(3.0)	10(19.0)	10(3.0)	10(20.3)	10(7.0)	10(14.1)	8(15.2)
426	*Aster conspicuus*	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	4(1.3)	2(1.8)
586	*Aster perelegans*	10(3.0)	5(0.5)	5(0.5)	5(3.0)	7(0.5)	3(1.8)	1(0.5)
430	*Astragalus miser*	10(0.5)	0(0.0)	0(0.0)	5(3.0)	0(0.0)	0(0.0)	2(15.0)
431	*Balsamhoriza sagittata*	10(3.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	1(0.5)	2(0.5)
438	*Castilleja miniata*	0(0.0)	5(0.5)	5(15.0)	0(0.0)	0(0.0)	3(0.5)	3(0.5)
442	*Chimaphila umbellata*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)
459	*Epilobium angustifolium*	0(0.0)	5(0.5)	10(9.0)	0(0.0)	3(0.5)	1(0.5)	2(0.5)
615	*Frasera montana*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
465	*Fragaria vesca*	0(0.0)	5(0.5)	0(0.0)	5(15.0)	3(0.5)	3(1.8)	5(1.2)
466	*Fragaria virginiana*	0(0.0)	5(0.5)	0(0.0)	5(15.0)	0(0.0)	0(0.0)	2(0.5)
473	*Geranium viscosissimum*	10(3.0)	0(0.0)	5(15.0)	5(0.5)	3(3.0)	1(0.5)	0(0.0)
483	*Hieracium albertinum*	10(0.5)	0(0.0)	0(0.0)	5(15.0)	0(0.0)	3(0.5)	0(0.0)
484	*Hieracium albiflorum*	0(0.0)	0(0.0)	5(0.5)	0(0.0)	3(3.0)	1(3.0)	1(0.5)
833	*Iliamna rivularis*	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
635	*Kelloggia galioides*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
495	*Lithospermum ruderale*	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
499	*Lupinus* spp.	0(0.0)	10(7.8)	0(0.0)	5(3.0)	3(0.5)	7(12.1)	4(1.5)

[1]Constancy values: + = >0-5%, 1 = >5-15%, 2 = >15-25%, 3 = >25-35%, 4 = >35-45%, 5 = >45-55%, 6 = >55-65%, 7 = >65-75%, 8 = >75-85%, 9 = >85-95%, 10 = >95-100%.

(con.)

APPENDIX B-2 (Con.)

HERB LAYER GROUP		Annuals	*Potentilla glandulosa*	*Geranium viscosissimum*	*Fragaria vesca*	*Carex geyeri*		*Calamagrostis rubescens*
Herb layer type		ANN. -CAGE	POGL -CARU	GEVI -CARU	FRVE -CARU	CAGE -CAGE	CAGE -CARU	CARU -CARU
Number of stands		1	2	2	2	3	7	13
Codes	**Species**	Constancy[1] (percent canopy cover)						
	Perennial graminoids							
[2]#46	*Osmorhiza* spp.	10(3.0)	0(0.0)	0(0.0)	10(1.8)	7(9.0)	3(0.5)	2(1.8)
506	*Osmorhiza occidentalis*	10(0.5)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	1(0.5)	0(0.0)
656	*Paeonia brownii*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
#23	*Penstemon* spp.	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)	0(0.0)
658	*Penstemon attenuatus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
661	*Penstemon payettensis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
514	*Penstemon wilcoxii*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)	2(0.5)
522	*Potentilla glandulosa*	0(0.0)	10(15.0)	5(0.5)	0(0.0)	3(0.5)	4(2.2)	5(0.5)
542	*Smilacina racemosa*	10(3.0)	0(0.0)	0(0.0)	5(3.0)	7(7.8)	0(0.0)	2(1.3)
#47	*Thalictrum* spp.	10(15.0)	0(0.0)	10(0.5)	5(15.0)	7(15.0)	3(9.0)	1(0.5)
[3]*09	*Tragopogon dubius*	0(0.0)	5(0.5)	5(0.5)	0(0.0)	3(0.5)	0(0.0)	0(0.0)
551	*Valeriana sitchensis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
691	*Veratrum californicum*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
695	*Viola purpurea*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
	Annuals, biennials, and short-lived perennials							
*11	*Bromus tectorum*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
595	*Chaenactis douglasii*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
*12	*Cirsium vulgare*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
912	*Clarkia rhomboidea*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
#56	*Collomia* spp.	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	1(0.5)	0(0.0)
902	*Collinsia parviflora*	10(15.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
914	*Cryptantha affinis*	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
904	*Epilobium* spp.	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
905	*Galium aparine*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
919	*Galium bifolium*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
930	*Gayophytum* spp.	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)
886	*Gnaphalium microcephalum*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
*02	*Lactuca serriola*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
920	*Nemophila breviflora*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
918	*Nemophila parviflora*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
#51	*Phacelia* spp.	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)
*16	*Verbascum thapsus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
999	Bare soil	0(0.0)	10(9.0)	10(1.8)	0(0.0)	3(3.0)	6(1.8)	2(1.3)
Years since disturbance								
	average	—	—	—	—	—	19	61
	range	—	17-21	16-18	—	22	13-27	16-120

[1]Constancy values: + = >0-5%; 1 = >5-15%; 2 = >15-25%; 3 = >25-35%; 4 = >35-45%; 5 = >45-55%; 6 = >55-65%; 7 = >65-75%; 8 = >75-85%; 9 = >85-95%; 10 = >95-100%.

[2]# = genus listing.

[3]* = nonnative species.

(con.)

APPENDIX B-3: PALATABILITY RATINGS, CONSTANCY, AND AVERAGE PERCENT CANOPY COVER OF HERB LAYER SPECIES BY LAYER TYPE IN THE PSME/SPBE H.T., SPBE PHASE

		Palatability ratings[1]								
		Deer		Elk		Cattle	Sheep	Black bear		
Codes	Species	Summer	Winter	Summer	Winter	Summer	Summer	Spring	Summer	Fall
	Perennial graminoids									
301	*Agropyron spicatum*	2	4	4	6	4	2	0	0	0
303	*Bromus carinatus*	4	2	6	4	6	4	0	0	0
282	*Bromus inermis*	4	4	6	4	6	4	0	0	0
307	*Calamagrostis rubescens*	2	4	6	4	6	4	6	4	2
309	*Carex geyeri*	4	4	6	6	6	4	6	4	2
311	*Carex rossii*	2	2	4	2	2	4	6	4	2
316	*Elymus glaucus*	2	0	6	4	3	2	0	0	0
317	*Festuca occidentalis*	4	4	4	6	6	6	0	0	0
331	*Poa nervosa*	4	2	6	4	4	4	0	0	0
	Perennial forbs									
401	*Achillea millefolium*	2	2	2	2	2	4	0	0	0
566	*Agastache urticifolia*	4	0	4	0	4	6	0	0	0
414	*Antennaria microphylla*	4	2	2	2	2	4	0	0	0
413	*Antennaria racemosa*	4	2	2	2	2	4	0	0	0
415	*Apocynum androsaemifolium*	2	0	2	0	2	2	0	0	0
420	*Arenaria macrophylla*	2	0	2	0	2	4	0	0	0
421	*Arnica cordifolia*	4	0	4	0	2	4	0	0	0
426	*Aster conspicuus*	2	2	4	2	4	4	0	0	0
586	*Aster perelegans*	4	2	4	2	4	4	0	0	0
430	*Astragalus miser*	0	0	2	0	2	2	0	0	0
431	*Balsamhoriza sagittata*	4	4	2	4	4	6	0	0	0
438	*Castilleja miniata*	2	0	2	0	2	2	0	0	0
442	*Chimaphila umbellata*	0	0	0	0	0	0	0	0	0
459	*Epilobium angustifolium*	4	2	6	2	2	4	0	0	0
615	*Frasera montana*	2	2	4	2	4	4	0	0	0
465	*Fragaria vesca*	4	4	2	4	2	4	2	6	2
466	*Fragaria virginiana*	2	2	2	4	2	4	2	6	2
473	*Geranium viscosissimum*	4	2	6	2	2	4	0	0	0
483	*Hieracium albertinum*	4	2	4	2	6	6	0	0	0
484	*Hieracium albiflorum*	4	2	4	2	6	6	0	0	0
833	*Iliamna rivularis*	4	0	6	0	4	6	0	0	0
635	*Kelloggia galioides*	2	0	2	0	2	4	0	0	0
495	*Lithospermum ruderale*	4	2	4	2	2	4	0	0	0
499	*Lupinus* spp.	4	2	2	4	2	4	0	0	0

[1]Palatability ratings (0-6) are from Kufeld and others (1973), Kufeld (1973), USDA Forest Service (1986), and Beecham (1981). Seasons are: spring (March, April, May); summer (June, July, August); fall (September, October, November); winter (December, January, February).

(con.)

APPENDIX B-3: (Con.)

		Palatability ratings[1]								
		Deer		Elk		Cattle	Sheep	Black bear		
Codes	Species	Summer	Winter	Summer	Winter	Summer	Summer	Spring	Summer	Fall
	Perennial forbs									
[2]#46	*Osmorhiza* spp.	2	0	0	0	2	4	6	4	2
506	*Osmorhiza occidentalis*	6	0	6	0	4	6	6	4	2
656	*Paeonia brownii*	2	0	2	0	2	2	0	0	0
#23	*Penstemon* spp.	4	2	2	2	2	4	0	0	0
658	*Penstemon attenuatus*	4	2	2	2	2	4	0	0	0
661	*Penstemon payettensis*	4	2	2	2	2	4	0	0	0
514	*Penstemon wilcoxii*	4	2	2	2	2	4	0	0	0
522	*Potentilla glandulosa*	4	2	4	2	2	4	0	0	0
542	*Smilacina racemosa*	6	2	4	2	2	4	6	4	2
#47	*Thalictrum* spp.	4	2	6	2	2	4	0	0	0
[3]*09	*Tragopogon dubius*	4	2	4	4	4	4	0	0	0
551	*Valeriana sitchensis*	4	0	6	0	2	4	0	0	0
691	*Veratrum californicum*	4	2	4	2	4	4	2	2	2
695	*Viola purpurea*	2	0	2	0	2	4	0	0	0
	Annuals, biennials, and short-lived perennials									
*11	*Bromus tectorum*	2	4	2	4	2	2	0	0	0
595	*Chaenactis douglasii*	2	4	2	2	2	2	0	0	0
*12	*Cirsium vulgare*	2	2	2	2	2	2	0	0	0
912	*Clarkia rhomboidea*	2	0	2	0	2	2	0	0	0
#56	*Collomia* spp.	2	0	2	0	2	2	0	0	0
902	*Collinsia parviflora*	2	0	2	0	2	2	0	0	0
914	*Cryptantha affinis*	0	0	0	0	0	2	0	0	0
904	*Epilobium* spp.	2	0	2	0	2	2	0	0	0
905	*Galium aparine*	2	0	2	0	2	2	6	4	2
919	*Galium bifolium*	2	0	2	0	2	2	0	0	0
930	*Gayophytum* spp.	2	0	2	0	2	2	0	0	0
886	*Gnaphalium microcephalum*	2	0	2	0	2	4	0	0	0
*02	*Lactuca serriola*	4	2	4	2	6	6	0	0	0
920	*Nemophila breviflora*	2	0	2	0	2	2	0	0	0
918	*Nemophila parviflora*	2	0	2	0	2	2	0	0	0
#51	*Phacelia* spp.	4	2	4	2	2	4	0	0	0
*16	*Verbascum thapsus*	2	2	2	2	2	2	0	0	0

[1]Palatability ratings (0-6) are from Kufeld and others (1973), Kufeld (1973), USDA Forest Service (1986), and Beecham (1981). Seasons are: spring (March, April, May); summer (June, July, August); fall (September, October, November); winter (December, January, February).
[2]# = genus listing.
[3]* = nonnative species.

(con.)

APPENDIX B-3 (Con.)

HERB LAYER GROUP		Annuals	*Bromus carinatus*			*Geranium viscosissimum*		*Carex geyeri*
Herb layer type		ANN. -ANN.	BRCA -ILRI	BRCA -GEVI	BRCA -CAGE	GEVI -GEVI	GEVI -CAGE	CAGE -CAGE
Number of stands		1	1	1	1	2	1	10
Codes	Species	Constancy[1] (percent canopy cover)						
	Perennial graminoids							
301	*Agropyron spicatum*	0(0.0)	10(0.5)	10(15.0)	0(0.0)	5(3.0)	0(0.0)	3(2.2)
303	*Bromus carinatus*	0(0.0)	10(15.0)	0(0.0)	10(15.0)	10(0.5)	0(0.0)	3(1.3)
282	*Bromus inermis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(3.0)
307	*Calamagrostis rubescens*	10(0.5)	0(0.0)	0(0.0)	0(0.0)	5(3.0)	0(0.0)	0(0.0)
309	*Carex geyeri*	0(0.0)	10(3.0)	0(0.0)	10(37.5)	5(3.0)	10(37.5)	6(26.4)
311	*Carex rossii*	0(0.0)	10(0.5)	10(3.0)	0(0.0)	5(0.5)	0(0.0)	2(0.5)
316	*Elymus glaucus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	2(1.8)
317	*Festuca occidentalis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
331	*Poa nervosa*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	10(3.0)	6(3.3)
	Perennial forbs							
401	*Achillea millefolium*	0(0.0)	0(0.0)	10(0.5)	10(0.5)	0(0.0)	0(0.0)	2(0.5)
566	*Agastache urticifolia*	10(3.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
414	*Antennaria microphylla*	0(0.0)	0(0.0)	0(0.0)	10(0.5)	0(0.0)	0(0.0)	0(0.0)
413	*Antennaria racemosa*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(1.3)
415	*Apocynum androsaemifolium*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(3.0)
420	*Arenaria macrophylla*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)
421	*Arnica cordifolia*	0(0.0)	0(0.0)	0(0.0)	10(0.5)	5(0.5)	0(0.0)	5(12.6)
426	*Aster conspicuus*	0(0.0)	0(0.0)	0(0.0)	10(0.5)	5(0.5)	0(0.0)	3(5.3)
586	*Aster perelegans*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	10(3.0)	3(1.3)
430	*Astragalus miser*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	4(8.4)
431	*Balsamhoriza sagittata*	0(0.0)	0(0.0)	10(15.0)	0(0.0)	5(15.0)	10(15.0)	4(1.8)
438	*Castilleja miniata*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	10(15.0)	2(0.5)
442	*Chimaphila umbellata*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
459	*Epilobium angustifolium*	10(0.5)	0(0.0)	0(0.0)	10(0.5)	5(3.0)	0(0.0)	2(0.5)
615	*Frasera montana*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)
465	*Fragaria vesca*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	2(1.8)
466	*Fragaria virginiana*	0(0.0)	0(0.0)	10(3.0)	0(0.0)	0(0.0)	0(0.0)	2(0.5)
473	*Geranium viscosissimum*	0(0.0)	10(0.5)	0(0.0)	0(0.0)	5(15.0)	10(15.0)	2(1.8)
483	*Hieracium albertinum*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	10(0.5)	2(0.5)
484	*Hieracium albiflorum*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(3.0)
833	*Iliamna rivularis*	10(3.0)	10(15.0)	0(0.0)	0(0.0)	5(3.0)	0(0.0)	1(0.5)
635	*Kelloggia galioides*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(3.0)
495	*Lithospermum ruderale*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)
499	*Lupinus* spp.	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)

[1]Constancy values: + = >0-5% 1 = >5-15% 2 = >15-25% 3 = >25-35% 4 = >35-45% 5 = >45-55% 6 = >55-65% 7 = >65-75% 8 = >75-85% 9 = >85-95% 10 = >95-100%.

(con.)

APPENDIX B-3 (Con.)

HERB LAYER GROUP		Annuals	Bromus carinatus			Geranium viscosissimum		Carex geyeri
Herb layer type		ANN. -ANN.	BRCA -ILRI	BRCA -GEVI	BRCA -CAGE	GEVI -GEVI	GEVI -CAGE	CAGE -CAGE
Number of stands		1	1	1	1	2	1	10
Codes	Species	Constancy[1] (percent canopy cover)						
	Perennial graminoids							
[2]#46	*Osmorhiza* spp.	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(3.0)
506	*Osmorhiza occidentalis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)
656	*Paeonia brownii*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)
#23	*Penstemon* spp.	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)
658	*Penstemon attenuatus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)
661	*Penstemon payettensis*	0(0.0)	10(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
514	*Penstemon wilcoxii*	0(0.0)	10(0.5)	0(0.0)	10(0.5)	5(0.5)	0(0.0)	0(0.0)
522	*Potentilla glandulosa*	10(0.5)	10(0.5)	0(0.0)	10(15.0)	5(0.5)	10(3.0)	5(1.0)
542	*Smilacina racemosa*	10(0.5)	0(0.0)	0(0.0)	10(0.5)	10(0.5)	0(0.0)	2(0.5)
#47	*Thalictrum* spp.	10(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	10(0.5)	4(14.0)
[3]*09	*Tragopogon dubius*	0(0.0)	0(0.0)	0(0.0)	10(0.5)	5(0.5)	0(0.0)	0(0.0)
551	*Valeriana sitchensis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
691	*Veratrum californicum*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
695	*Viola purpurea*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
	Annuals, biennials, and short-lived perennials							
*11	*Bromus tectorum*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
595	*Chaenactis douglasii*	0(0.0)	10(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
*12	*Cirsium vulgare*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)
912	*Clarkia rhomboidea*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
#56	*Collomia* spp.	10(3.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
902	*Collinsia parviflora*	10(85.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
914	*Cryptantha affinis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
904	*Epilobium* spp.	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)
905	*Galium aparine*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
919	*Galium bifolium*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
930	*Gayophytum* spp.	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)
886	*Gnaphalium microcephalum*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
*02	*Lactuca serriola*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)
920	*Nemophila breviflora*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
918	*Nemophila parviflora*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
#51	*Phacelia* spp.	0(0.0)	10(0.5)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	2(0.5)
*16	*Verbascum thapsus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
999	Bare soil	10(3.0)	10(3.0)	0(0.0)	10(15.0)	5(15.0)	10(15.0)	2(9.0)
Years since disturbance								
	average	—	—	—	—	—	—	56
	range	11	10	—	24	—	18	18-100

[1]Constancy values: + = >0-5%, 1 = >5-15%, 2 = >15-25%, 3 = >25-35%, 4 = >35-45%, 5 = >45-55%, 6 = >55-65%, 7 = >65-75%, 8 = >75-85%, 9 = >85-95%, 10 = >95-100%.

[2]# = genus listing.

[3]* = nonnative species.

APPENDIX C: SUCCESSION AND MANAGEMENT FIELD FORM FOR THE DOUGLAS-FIR/WHITE SPIREA H.T.

Name: ______________________ Location: ______________________

Date: __________ Elevation: __________ Aspect: __________ Slope(%): __________

Plot No.: __________

Topography (circle):
Ridge — Mid slope
Upper slope — Bench or Flat
Lower slope — Stream bottom

Configuration (circle):
Concave (dry) — Convex (wet)
Straight — Undulating

Canopy Cover Classes:

0 - None	1 - 1 to 5%	3 - 25 to 50%	5 - 75 to 95%
T - Trace to 1%	2 - 5 to 25%	4 - 50 to 75%	6 - 95 to 100%

CANOPY COVERS

TREES

Code	Rate coverage by d.b.h. classes:	o. >18"	m. 18-12"	p. 12-4"	s. 4-.1"
001	*Abies grandis*	/	/	/	/
002	*Abies lasiocarpa*	/	/	/	/
006	*Larix occidentalis*	/	/	/	/
007	*Picea engelmannii*	/	/	/	/
010	*Pinus contorta*	/	/	/	/
013	*Pinus ponderosa*	/	/	/	/
014	*Populus tremuloides*	/	/	/	/
016	*Pseudotsuga menziesii*	/	/	/	/

SHRUBS

Code		
105	*Amelanchier alnifolia*	
150	*Artemisia tridentata*	
107	*Ceanothus velutinus*	
108	*Chrysothamnus nauseosus*	
123	*Prunus emarginata*	
124	*Prunus virginiana*	
125	*Purshia tridentata*	
128	*Ribes cereum*	
131	*Ribes viscosissimum*	
#01	*Rosa* spp.	
137	*Salix scouleriana*	
139	*Shepherdia canadensis*	
142	*Spiraea* spp.	
163	*Symphoricarpos oreophilus*	

PERENNIAL GRAMINOIDS

Code		
301	*Agropyron spicatum*	
303	*Bromus carinatus*	
282	*Bromus inermis*	
307	*Calamagrostis rubescens*	
309	*Carex geyeri*	
311	*Carex rossii*	

PERENNIAL FORBS

Code		
415	*Apocynum androsaemifolium*	
421	*Arnica cordifolia*	
426	*Aster conspicuus*	
586	*Aster perelegans*	
421	*Balsamorhiza sagittata*	
#15	*Castilleja* spp.	
459	*Epilobium angustifolium*	
465	*Fragaria vesca*	
466	*Fragaria virginiana*	
473	*Geranium viscosissimum*	
833	*Iliamna rivularis*	
636	*Lathyrus nevadensis*	
499	*Lupinus* spp.	
658	*Penstemon attenuatus*	
522	*Potentilla glandulosa*	
547	*Thalictrum occidentale*	
691	*Veratrum californicum*	

ANNUALS, BIENNIALS, and SHORT-LIVED PERENNIALS

Code		
*12	*Cirsium vulgare*	
#56	*Collomia* spp.	
914	*Cryptantha* spp.	
904	*Epilobium* spp.	
930	*Gayophytum* spp.	
886	*Gnaphalium* spp.	
663	*Phacelia hastata*	
911	*Polygonum douglasii*	
*16	*Verbascum thapsus*	

TREE LAYER TYPE	
SHRUB LAYER TYPE	
HERB LAYER TYPE	

Steele, Robert; Geier-Hayes, Kathleen. 1994. The Douglas-fir/white spirea habitat type in central Idaho: succession and management. Gen. Tech. Rep. INT-305. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 81 p.

Presents a taxonomic system for classifying plant succession in the Douglas-fir/white spirea habitat type in central Idaho. A total of 10 potential tree layer types, 35 shrub layer types, and 45 herb layer types are categorized. Diagnostic keys based on indicator species assist field identification of the types. Discussion of management implications includes pocket gopher populations, success of planted and natural tree seedlings, big-game and livestock forage preferences, and responses of major shrub and herb layer species to disturbance.

KEYWORDS: forest succession, plant communities, forest ecology, forest management, silviculture, classification, Idaho

SUCCESSION AND MANAGEMENT FIELD FORM FOR THE DOUGLAS-FIR/ WHITE SPIREA H.T.

Name: ______________________ Location: ______________________

Date: ____________ Elevation: ____________ Aspect: ____________ Slope(%): ____________

Plot No.: ____________

Topography (circle):
- Ridge
- Upper slope
- Lower slope
- Mid slope
- Bench or Flat
- Stream bottom

Configuration (circle):
- Concave (dry)
- Straight
- Convex (wet)
- Undulating

Canopy Cover Classes:

0 - None	1 - 1 to 5%	3 - 25 to 50%	5 - 75 to 95%
T - Trace to 1%	2 - 5 to 25%	4 - 50 to 75%	6 - 95 to 100%

CANOPY COVERS

TREES

Rate coverage by d.b.h. classes:

Code		o. >18" /	m. 18-12" /	p. 12-4" /	s. 4-.1" /
001	*Abies grandis*	____/	____/	____/	____/
002	*Abies lasiocarpa*	____/	____/	____/	____/
006	*Larix occidentalis*	____/	____/	____/	____/
007	*Picea engelmannii*	____/	____/	____/	____/
010	*Pinus contorta*	____/	____/	____/	____/
013	*Pinus ponderosa*	____/	____/	____/	____/
014	*Populus tremuloides*	____/	____/	____/	____/
016	*Pseudotsuga menziesii*	____/	____/	____/	____/

SHRUBS

Code		
105	*Amelanchier alnifolia*	____
150	*Artemisia tridentata*	____
107	*Ceanothus velutinus*	____
108	*Chrysothamnus nauseosus*	____
123	*Prunus emarginata*	____
124	*Prunus virginiana*	____
125	*Purshia tridentata*	____
128	*Ribes cereum*	____
131	*Ribes viscosissimum*	____
#01	*Rosa* spp.	____
137	*Salix scouleriana*	____
139	*Shepherdia canadensis*	____
142	*Spiraea* spp.	____
163	*Symphoricarpos oreophilus*	____

PERENNIAL GRAMINOIDS

Code		
301	*Agropyron spicatum*	____
303	*Bromus carinatus*	____
282	*Bromus inermis*	____
307	*Calamagrostis rubescens*	____
309	*Carex geyeri*	____
311	*Carex rossii*	____

PERENNIAL FORBS

Code		
415	*Apocynum androsaemifolium*	____
421	*Arnica cordifolia*	____
426	*Aster conspicuus*	____
586	*Aster perelegans*	____
421	*Balsamorhiza sagittata*	____
#15	*Castilleja* spp.	____
459	*Epilobium angustifolium*	____
465	*Fragaria vesca*	____
466	*Fragaria virginiana*	____
473	*Geranium viscosissimum*	____
833	*Iliamna rivularis*	____
636	*Lathyrus nevadensis*	____
499	*Lupinus* spp.	____
658	*Penstemon attenuatus*	____
522	*Potentilla glandulosa*	____
547	*Thalictrum occidentale*	____
691	*Veratrum californicum*	____

ANNUALS, BIENNIALS, and SHORT-LIVED PERENNIALS

Code		
*12	*Cirsium vulgare*	____
#56	*Collomia* spp.	____
914	*Cryptantha* spp.	____
904	*Epilobium* spp.	____
930	*Gayophytum* spp.	____
886	*Gnaphalium* spp.	____
663	*Phacelia hastata*	____
911	*Polygonum douglasii*	____
*16	*Verbascum thapsus*	____

TREE LAYER TYPE	
SHRUB LAYER TYPE	
HERB LAYER TYPE	

KEYS TO TREE, SHRUB, AND HERB LAYER TYPES, WITH ADP CODES, IN THE PSME/CARU H. T.

Tree layer

		Codes
1. *Populus tremuloides* well represented[1]	POTR LAYER GROUP	014
1a. *Populus tremuloides* dominant	POTR-POTR Layer Type	014.014
1b. *Pinus contorta* dominant or codominant	POTR-PICO Layer Type	014.010
1c. *Pinus ponderosa* dominant or codominant	POTR-PIPO Layer Type	014.013
1d. *Pseudotsuga menziesii* dominant or codominant	POTR-PSME Layer Type	014.016
1. *P. tremuloides* poorly represented	2	
2. *Pinus contorta* well represented	PICO LAYER GROUP	010
2a. *Pinus contorta* dominant	PICO-PICO Layer Type	010.010
2b. *Pinus ponderosa* dominant or codominant	PICO-PIPO Layer Type	010.013
2c. *Pseudotsuga menziesii* dominant or codominant	PICO-PSME Layer Type	010.016
2. *P. contorta* poorly represented	3	
3. *Pinus ponderosa* well represented	PIPO LAYER GROUP	013
3a. *Pinus ponderosa* dominant	PIPO-PIPO Layer Type	013.013
3b. *Pseudotsuga menziesii* dominant or codominant	PIPO-PSME Layer Type	013.016
3. *P. ponderosa* poorly represented	4	
4. *Pseudotsuga menziesii* well represented	PSME LAYER GROUP	016
4a. *Pseudotsuga menziesii* dominant	PSME-PSME Layer Type	016.016
4. *P. menziesii* poorly represented	Depauperate or undescribed tree layer or not PSME/SPBE h.t.	

Shrub layer, PIPO Phase

		Codes
1. *Purshia tridentata* (including *Artemisia*) well represented	PUTR LAYER GROUP	125
1a. *Purshia* (including *Artemisia*) dominant	PUTR-PUTR Layer Type	125.125
1b. *Ceanothus* spp./ dominant or codominant	PUTR-CEVE Layer Type	125.107
1c. *Ribes* spp. dominant or codominant	PUTR-RICE Layer Type	125.128
1d. *Salix* dominant or codominant	PUTR-SASC L ayer Type	125.137
1e. *Prunus* spp. dominant or codominant	PUTR-PRVI Layer Type	125.124
1f. *Amelanchier* (including *Symphoricarpos oreophilus*) dominant or codominant	PUTR-AMAL Layer Type	125.105
1g. *Spiraea* spp. dominant or codominant	PUTR-SPBE Layer Type	125.142
1. *Purshia* (including *Artemisia*) poorly represented	2	
2. *Ceanothus velutinus* (including *C. sanguineus*) well represented	CEVE LAYER GROUP	107
2a. *Ceanothus* spp. dominant	CEVE-CEVE Layer Type	107.107
2b. *Ribes* spp. dominant or codominant	CEVE-RICE Layer Type	107.128
2c. *Salix* dominant or codominant	CEVE-SASC Layer Type	107.137
2d. *Prunus* spp. dominant or codominant	CEVE-PRVI Layer Type	107.124
2e. *Amelanchier* (including *Symphoricarpos oreophilus*) dominant or codominant	CEVE-AMAL Layer Type	107.105
2f. *Spiraea* spp. dominant or codominant	CEVE-SPBE Layer Type	107.142
2. *Ceanothus* spp. poorly represented	3	
3. *Ribes cereum* (including *R. viscosissimum*) well represented	RICE LAYER GROUP	128
3a. *Ribes* spp. dominant	RICE-RICE Layer Type	128.128
3b. *Salix* dominant or codominant	RICE-SASC Layer Type	128.137
3c. *Prunus* spp. dominant or codominant	RICE-PRVI Layer Type	128.124
3d. *Amelanchier* (including *Symphoricarpos oreophilus*) dominant or codominant	RICE-AMAL Layer Type	128.105
3e. *Spiraea* spp. dominant or codominant	RICE-SPBE Layer Type	128.142
3. *Ribes* spp. poorly represented	4	

(con.)

[1]"Well represented" means canopy coverage ≥5 percent. Trees less than 4.5 feet (1.4 meters) tall should be omitted from coverage estimates. "Dominant" refers to greatest canopy coverage regardless of height, "codominant" refers to nearly equal canopy coverage. When keying to layer type, choose first condition that fits. First go through key to select layer group, then key to layer type.

Shrub layer (Con.)

		Codes
4. *Salix scouleriana* well represented	SASC LAYER GROUP	137
4a. *Salix* dominant	SASC-SASC Layer Type	137.137
4b. *Prunus* spp. dominant or codominant	SASC-PRVI Layer Type	137.124
4c. *Amelanchier* (including *Symphoricarpos oreophilus*) dominant or codominant	SASC-AMAL Layer Type	137.105
4d. *Spiraea* spp. dominant or codominant	SASC-SPBE Layer Type	137.142
4. *Salix* poorly represented	5	
5. *Prunus virginiana* (including *P. emarginata*) well represented	PRVI LAYER GROUP	124
5a. *Prunus* spp. dominant	PRVI-PRVI Layer Type	124.124
5b. *Amelanchier* (including *Symphoricarpos oreophilus*) dominant or codominant	PRVI-AMAL Layer Type	124.105
5c. *Spiraea* spp. dominant or codominant	PRVI-SPBE Layer Type	124.142
5. *Prunus* spp. poorly represented	6	
6. *Amelanchier alnifolia* (including *Symphoricarpos oreophilus*) well represented	AMAL LAYER GROUP	105
6a. *Amelanchier* (including *Symphoricarpos oreophilus*) dominant	AMAL-AMAL Layer Type	105.105
6b. *Spiraea* spp. dominant or codominant	AMAL-SPBE Layer Type	105.142
6. *Amelanchier* (including *S. oreophilus*) poorly represented	7	
7. *Spiraea betulifolia* (including *S. pyramidata*) well represented	SPBE LAYER GROUP	142
7a. *Spiraea* spp. dominant	SPBE-SPBE Layer Type	142.142
7. *Spiraea* spp. poorly represented	Depauperate or unclassified layer type	

Shrub layer, CARU and SPBE Phases

		Codes
1. *Artemisia tridentata* (including *Chrysothamnus*) well represented	ARTR LAYER GROUP	150
1a. *Artemisia* (including *Chrysothamnus*) dominant	ARTR-ARTR Layer Type	150.150
1b. *Ceanothus* (including *Shepherdia*) dominant or codominant	ARTR-CEVE Layer Type	150.107
1c. *Ribes* spp. dominant or codominant	ARTR-RICE Layer Type	150.128
1d. *Salix* dominant or codominant	ARTR-SASC Layer Type	150.137
1e. *Prunus* spp. dominant or codominant	ARTR-PRVI Layer Type	150.124
1f. *Symphoricarpos oreophilus* (including *Amelanchier* dominant or codominant	ARTR-SYOR Layer Type	150.163
1g. *Spiraea* spp. (including *Pachistima*) dominant or codominant	ARTR-SPBE Layer Type	150.142
1. *Artemisia tridentata* (including *Chrysothamnus*) poorly represented	2	
2. *Ceanothus velutinus* (including *Shepherdia canadensis*) well represented	CEVE LAYER GROUP	107
2a. *Ceanothus* (including *Shepherdia*) dominant	CEVE-CEVE Layer Type	107.107
2b. *Ribes* spp. dominant or codominant	CEVE-RICE Layer Type	107.128
2c. *Salix* dominant or codominant	CEVE-SASC Layer Type	107.137
2d. *Prunus* spp. dominant or codominant	CEVE-PRVI Layer Type	107.124
2e. *Symphoricarpos oreophilus* (including *Amelanchier*) dominant or codominant	CEVE-SYOR Layer Type	107.163
2f. *Spiraea* spp. (incudingl *Pachistima*) dominant or codominant	CEVE-SPBE Layer Type	107.142
2. *Ceanothus* spp. poorly represented	3	
3. *Ribes cereum* (including *R. viscosissimum*) well represented	RICE LAYER GROUP	128
3a. *Ribes* spp. dominant	RICE-RICE Layer Type	128.128
3b. *Salix* dominant or codominant	RICE-SASC Layer Type	128.137

(con.)

Shrub layer (Con.)

		Codes
3c. *Prunus* spp. dominant or codominant	RICE-PRVI Layer Type	128.124
3d. *Symphoricarpos* (including *Amelanchier*) dominant or codominant	RICE-SYOR Layer Type	128.163
3e. *Spiraea* spp. (including *Pachistima*) dominant or codominant	RICE-SPBE Layer Type	128.142
3. *Ribes* spp. poorly represented	4	
4. *Salix scouleriana* well represented	SASC LAYER GROUP	137
4a. *Salix* dominant	SASC-SASC Layer Type	137.137
4b. *Prunus* spp. dominant or codominant	SASC-PRVI Layer Type	137.124
4c. *Symphoricarpos* (including *Amelanchier*) dominant or codominant	SASC-SYOR Layer Type	137.163
4d. *Spiraea* spp. (including *Pachistima*) dominant or codominant	SASC-SPBE Layer Type	137.142
4. *Salix* poorly represented	5	
5. *Prunus virginiana* (including *P. emarginata*) well represented	PRVI LAYER GROUP	124
5a. *Prunus* spp. dominant	PRVI-PRVI Layer Type	124.124
5b. *Symphoricarpos* (including *Amelanchier*) dominant or codominant	PRVI-SYOR Layer Type	124.163
5c. *Spiraea* spp. (including *Pachistima*) dominant or codominant	PRVI-SPBE Layer Type	124.142
5. *Prunus* spp. poorly represented	6	
6. *Symphoricarpos oreophilus* (including *Amelanchier*) well represented	SYOR LAYER GROUP	163
6a. *Symphoricarpos* (including *Amelanchier*) dominant	SYOR-SYOR Layer Type	163.163
6b. *Spiraea* spp. (including *Pachistima*) dominant or codominant	SYOR-SPBE Layer Type	163.142
6. *Symphoricarpos* (including *Amelanchier*) poorly represented	7	
7. *Spiraea betulifolia* (including *S. pyramidata* and *Pachistima myrsinites*) well represented	SPBE LAYER GROUP	142
7a. *Spiraea* spp. (including *Pachistima*) dominant	SPBE-SPBE Layer Type	142.142
7. *Spiraea* spp. (including *Pachistima*) poorly represented	Depauperate or unclassified layer type.	

Herb layer

		Codes
1. Annuals, biennials, and short-lived perennials (see layer group description for species) well represented either individually or collectively	ANNUALS LAYER GROUP	900
1a. The above species dominant	ANN.-ANN. Layer Type	900.900
1b. *Bromus carinatus* (including and *Agropyron* spp.) dominant or codominant	ANN.-BRCA Layer Type	900.303
1c. *Potentilla glandulosa* (including *Carex rossii*) dominant or codominant	ANN.-POGL Layer Type	900.522
1d. *Iliamna rivularis* dominant or codominant	ANN.-ILRI Layer Type	900.833
1e. *Geranium viscosissimum* (including *Aster perelegans*, *Balsamorhiza*, *Penstemon attenuatus*, *Epilobium*, *Bromus inermis*, and *Castilleja*) dominant or codominant	ANN.-GEVI Layer Type	900.473
1f. *Apocynum androsaemifolium* (including *Veratrum*) dominant or codominant	ANN.-APAN Layer Type	900.415

(con.)

Herb layer (Con.)

		Codes
1g. *Fragaria vesca* (including *F. virginiana*) dominant or codominant	ANN.-FRVE Layer Type	900.465
1h. *Carex geyeri* (including *Aster conspicuus* and *Lupinus* spp.) dominant or codominant	ANN.-CAGE Layer Type	900.309
1i. *Calamagrostis rubescens* (including *Arnica* and *Thalictrum*) dominant or codominant	ANN.-CARU Layer Type	900.307
1. Annuals, biennials, and short-lived perennials poorly represented	2	
2. *Bromus carinatus* (including and *Agropyron* spp.) well represented	BRCA LAYER GROUP	303
2a. The above species dominant	BRCA-BRCA Layer Type	303.303
2b. *Potentilla glandulosa* (including *Carex rossii*) dominant or codominant	BRCA-POGL Layer Type	303.522
2c. *Iliamna rivularis* dominant or codominant	BRCA-ILRI Layer Type	303.833
2d. *Geranium viscosissimum* (including *Aster perelgans*, *Balsamorhiza*, *Penstemon attenuatus*, *Epilobium*, and *Castilleja*) dominant or codominant.	BRCA-GEVI Layer Type	303.473
2e. *Apocynum androsaemifolium* (including *Veratrum*) dominant or dominant.	BRCA-APAN Layer Type	303.415
2f. *Fragaria vesca* (including *F. virginiana*) dominant or codominant	BRCA-FRVE Layer Type	303.465
2g. *Carex geyeri* (including *Aster conspicuus* and *Lupinus* spp.) dominant or codominant.	BRCA-CAGE Layer Type	303.309
2h. *Calamagrostis rubescens* (including *Arnica* and *Thalictrum*) dominant or codominant	BRCA-CARU Layer Type	303.307
2. *Bromus carinatus* (including *Agropyron* spp.) poorly represented.	3	
3. *Potentilla glandulosa* (including *Carex rossii*) well represented.	POGL LAYER GROUP	522
3a. The above species dominant	POGL-POGL Layer Type	522.522
3b. *Iliamna rivularis* dominant or codominant	POGL-ILRI Layer Type	522.833
3c. *Geranium viscosissimum* (including *Aster perelegans*, *Balsamorhiza*, *Penstemon attenuatus*, *Epilobium*, *Bromus inermis*, and *Castilleja*) dominant or codominant	POGL-GEVI Layer Type	522.473
3d. *Apocynum androsaemifolium* (including *Veratrum*) dominant or codominant	POGL-APAN Layer Type	522.415
3e. *Fragaria vesca* (including *F. virginiana*) dominant or codominant	POGL-FRVE Layer Type	522.465
3f. *Carex geyeri* (including *Aster conspicuus* and *Lupinus* spp.) dominant or codominant	POGL-CAGE Layer Type	522.309
3g. *Calamagrostis rubescens* (including *Arnica* and *Thalictrum*) dominant or codominant	POGL-CARU Layer Type	522.307
3. *Potentilla* (including *Carex rossii*) poorly represented	4	
4. *Iliamna rivularis* well represented	ILRI LAYER GROUP	833
4a. *Iliamna rivularis* dominant	ILRI-ILRI Layer Type	833.833

(con.)

Herb layer (Con.)

		Codes
4b. *Geranium viscosissimum* (including *Aster perelegans, Balsamorhiza, Penstemon attenuatus, Epilobium, Bromus inermis* and *Castilleja*) dominant or codominant	ILRI-GEVI Layer Type	833.473
4c. *Apocynum androsaemifolium* (including *Veratrum*) dominant or codominant	ILRI-APAN Layer Type	833.415
4d. *Fragaria vesca* (including *F. virginiana*) dominant or codominant	ILRI-FRVE Layer Type	833.465
4e. *Carex geyeri* (including *Aster conspicuus* and *Lupinus* spp.) dominant or codominant	ILRI-CAGE Layer Type	833.309
4f. *Calamagrostis rubescens* (including *Arnica* and *Thalictrum*) dominant or codominant	ILRI-CARU Layer Type	833.307
4. *Iliamna* poorly represented	5	
5. *Geranium viscosissimum* (including *Aster perelegans, Balsamorhiza, Penstemon attenuatus, Eplilobium, Bromus inermis,* and *Castilleja*) well represented	GEVI LAYER GROUP	473
5a. The above species dominant	GEVI-GEVI Layer Type	473.473
5b. *Apocynum androsaemifolium* (including *Veratrum*) dominant or codominant	GEVI-APAN Layer Type	473.415
5c. *Fragaria vesca* (including *F. virginiana*) dominant or codominant	GEVI-FRVE Layer Type	473.465
5d. *Carex geyeri* (including *Aster conspicuus* and *Lupinus* spp.) dominant or codominant	GEVI-CAGE Layer Type	473.309
5e. *Calamagrostis rubescens* (including *Arnica* and *Thalictrum*) dominant or codominant	GEVI-CARU Layer Type	473.307
5. *Geranium* (including *Aster perelegans, Balsamorhiza, Penstemon, Epilobium, Bromus inermis*, and *Castilleja*) poorly represented	6	
6. *Apocynum androsaemifolium* (including *Veratrum*) well represented	APAN LAYER GROUP	415
6a. The above species dominant	APAN-APAN Layer Type	415.415
6b. *Fragaria vesca* (including *F. virginiana*) dominant or codominant	APAN-FRVE Layer Type	415.465
6c. *Carex geyeri* (including *Aster conspicuus* and *Lupinus* spp.) dominant or codominant	APAN-CAGE Layer Type	415.309
6d. *Calamagrostis rubescens* (including *Arnica* and *Thalictrum*) dominant or codominant	APAN-CARU Layer Type	415.307
6. *Apocynum* (including *Veratrum*) poorly represented	7	
7. *Fragaria vesca* (including *F. virginiana*) well represented	FRVE LAYER GROUP	465
7a. *Fragaria* spp. dominant	FRVE-FRVE Layer Type	465.465
7b. *Carex geyeri* (including *Aster conspicuus* and *Lupinus* spp.) dominant or codominant	FRVE-CAGE Layer Type	465.309
7c. *Calamagrostis rubescens* (including *Arnica* and *Thalictrum*) dominant or codominant	FRVE-CARU Layer Type	465.307
7. *Fragaria* spp. poorly represented	8	

(con.)

Herb layer (Con.)

		Codes
8. *Carex geyeri* (including *Aster conspicuus* and *Lupinus* spp.) well represented.	CAGE LAYER GROUP	309
8a. The above species dominant	CAGE-CAGE Layer Type	309.309
8b. *Calamagrostis rubescens* (including *Arnica* and *Thalictrum*) dominant or codominant	CAGE-CARU Layer Type	309.307
8. *Carex* (including *Aster* and *Lupinus*) poorly represented	9	
9. *Calamagrostis rubescens* (including *Arnica* and *Thalictrum*) well represented	CARU LAYER GROUP	307
9a. The above species dominant	CARU-CARU Layer Type	307.307
9. *Calamagrostis* (including *Arnica* and *Thalictrum*) poorly represented	Depauperate or unclassified layer type.	

INTERMOUNTAIN RESEARCH STATION

The Intermountain Research Station provides scientific knowledge and technology to improve management, protection, and use of the forests and rangelands of the Intermountain West. Research is designed to meet the needs of National Forest managers, Federal and State agencies, industry, academic institutions, public and private organizations, and individuals. Results of research are made available through publications, symposia, workshops, training sessions, and personal contacts.

The Intermountain Research Station territory includes Montana, Idaho, Utah, Nevada, and western Wyoming. Eighty-five percent of the lands in the Station area, about 231 million acres, are classified as forest or rangeland. They include grasslands, deserts, shrublands, alpine areas, and forests. They provide fiber for forest industries, minerals and fossil fuels for energy and industrial development, water for domestic and industrial consumption, forage for livestock and wildlife, and recreation opportunities for millions of visitors.

Several Station units conduct research in additional western States, or have missions that are national or international in scope.

Station laboratories are located in:

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Bozeman, Montana (in cooperation with Montana State University)

Logan, Utah (in cooperation with Utah State University)

Missoula, Montana (in cooperation with the University of Montana)

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